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OUTLINES OF SURGERY.

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OUTLINES OF SURGERY:

BEING AN

EPITOME OF THE LECTURES

ON THE

PRINCIPLES AND PRACTICE OF SURGERY

DELIVERED AT

ST. THOMAS'S HOSPITAL,

BY

F. LE GROS CLARK,

SURGEON TO THE HOSPITAL;
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MAGDALEN HOSPITAL.

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PREFACE.

THE present "Outlines" comprise, for the most part, little more than the notes from which the Author's Lectures have been delivered, somewhat amplified; and they are offered to the Student, in the hope that he may be encouraged to fill in the details from actual observation, and thereby cultivate a habit of self-reliance, instead of depending too much on book-teaching in his early studies. Illustrative notes and cases, thus collected by himself, can scarcely fail to be of lasting value to him in his future practice. Beyond this legitimate aim, the present volume can, of course, have no pretensions in common with more comprehensive "Systems" of Surgery.

Progress in scientific knowledge leads to generalisation; and, happily, Surgery affords no exception to this rule. Facts usually admit of a rational explanation, by referring them to the few and simple principles with which they are naturally allied. The author trusts that this association has been rendered apparent in the present epitome; and that the abruptness of diction, in which the information is conveyed, will be excused as inseparable from compressed descriptive writing.

The concluding Section is designed to compensate, in some measure, for the brevity with which subjects of great practical importance have been treated in the preceding Sections: and it is the wish and intention of the Author, at a convenient opportunity, to supplement these brief "Outlines," by the publication, in a collected form, of illustrative Clinical Lectures.

As this volume is intended especially for the Student of Surgery, a few words of general advice may be added. He must bring an earnest spirit to his work, for it demands the cultivation of many qualities of both heart and intellect. His early and close observation of Nature should teach him to appreciate and trust in her resources, and not to over-estimate his own: the sooner this necessary lesson is learned the better. He will perceive that the Art of Surgery is applied chiefly in removing mechanical obstacles to Nature's healing efforts, or in assisting those efforts in accordance with her indications and under her guidance; as, in the treatment of fracture, the relief of stricture, the removal of a sequestrum, or the excision of a joint. The Science of Surgery comprehends the principles which are designed to teach him how and when to exercise his Art, and the equally important, though not less difficult, lesson of judicious forbearance. In pursuing his studies, he must keep this distinction in view, and strive to maintain a healthy balance, as regards the time and value to be allotted to the guiding principles and the practical detail of his art: for, sound Principles, if unaccompanied by an acquaintance with their application, will be of little avail in actual Practice: and, on the other hand, the mere treasuring up of precedents for future guidance cannot fail to prove disappointing. It is true that a remedy may be correctly applied, because its success has been witnessed when it was employed by others. But this is not scientific knowledge; it is not satisfactory practice: for the apparently similar is often essentially different; and the Practitioner who is satisfied to act on precedent alone will continually find himself at fault, and also be deprived of the pleasure of practising his

Profession philosophically, instead of following it as little better than a trade. Armed with sound principles, and with such familiarity with their practical application as the period of probation permits him to acquire, the student may commence the practice of his Profession with self-reliance, though still a learner, and never relaxing in his desire to enlarge his stock of knowledge. But the foundation will have been laid; and every stone which subsequently comes to hand will find its appropriate place in the superstructure. His pile will thus assume, from the beginning, an architectural character, instead of becoming, as it may be feared is too often the case, a mere heap of fragments, unwieldy and comparatively useless, if not positively perplexing to the accumulator and possessor.

St. Thomas's Street,
Southwark; 1863.

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OUTLINES OF SURGERY.

SECTION I.

HEALTH—DISEASE—TEMPERAMENT.

A STATE of HEALTH implies the performance of all the functions of the body without disturbance. When this harmonious activity is interrupted, the existence either of functional derangement or of organic change is indicated. Functional derangement may lead to organic or structural change; or the latter may be the consequence of some sudden or accidental lesion. As organization signifies the presence of blood-vessels and nerves, so disease implies their functional disturbance.

Structural and *functional* DISEASE both vary greatly in their intensity. Though the latter is usually less important than the former, yet it may be fatal to life; whereas the former may exist with comparative freedom from risk. Functional disturbance may be secondary or sympathetic, as witnessed in almost every disease or injury to which the frame is liable.

The *sources* of disease are numerous. It may be conveyed to us from without, or may exist in a latent or inherited form within the body; its seeds are sown by excess, or it may result from accidental violence. What is disease? The aggregate symptoms which we usually treat as such are to be regarded as a curative effort of nature. Thus, the elements of consumption exist, in a latent form, as tubercle; the phenomena attending its softening and discharge constitute the disease; and in scarlet fever, the symptoms which we call the disease are the phenomena attending the elimination of a blood poison. So, in surgery, profuse suppuration, and other destructive consequences of severe injury, are strictly reparative in their nature, though fatal in their excess. To take this view of the phenomena of Disease *generally* will curb our impatience in their treatment, and induce us rather to watch, guide, help, and support Nature in her operations, than to attempt to oppose and control her, by ignoring her indications, and substituting our own theories respecting the cure of disease.

Any one organ or set of organs may be primarily the seat of disease, or may be involved secondarily either by sympathy or by their functions being inordinately taxed for vicarious elimination or otherwise.

The *phenomena* of diseased action have their seat especially in the vascular and nervous systems, and in each this morbid condition is evinced by either excessive or defective action. In some instances this excess or deficiency is in direct proportion in each; whilst in others it is developed in an inverse ratio, extreme nervous excitability being accompanied by feeble vascular energy.

In the study of pathology and the treatment of disease, it is to be remembered that the chemical affinities of inorganic matter are modified by vitality; and that, therefore, diseased products are not to be viewed as mere chemical compounds, nor is the action of medicines to be calculated on, as if the living body were a chemical laboratory.

The TEMPERAMENTS which most concern the surgeon are, the sanguine, the choleric, the phlegmatic, and the nervous. The activity of the circulation, the excitability of the nervous system, the tranquillity of the temper, have great influence in modifying disease, and in determining the effects of injury or operation. So likewise the reciprocal influence of body and mind, and the predisposition or hereditary tendency to certain forms of diseased action, must be studied; and the habits, whether temperate or self-indulgent, require to be taken into account in operations or in the treatment of surgical injuries.

GENERAL OR NERVOUS IRRITATION.

Every organ in a healthy state is susceptible of being excited to action by the presence of an appropriate stimulus; as the heart by the presence of blood, the stomach by the presence of food, the organs of sense by the appeal made, severally, to them. Thus, the function of an organ may be said to depend, for its activity, on the agency of an appropriate stimulus. Admitting this physiological basis, it follows that derangement of function has its source in either the excess or deficiency of excitability in an organ, or the presence of a morbidly exciting cause; both of these conditions may be in operation simultaneously.

IRRITATION, in its pathological sense, is the consequence of an irritant acting on a morbidly excitable organ, or of a morbid excess in its healthy excitability. This is distinct from inflammation, and has its seat in the nervous system, as the phenomena of the latter are especially localized in the vascular. Irritation may be local, *i.e.* affecting some particular organ or limited spot; or it may be general, *i. e.* extending over many organs, or involving the frame generally.

Local irritation may be either direct or sympathetic. Thus, a healthy stomach may be nauseated by disgusting food, and an irritable stomach by wholesome food; or such irritation may be the consequence of an appeal to another organ, as when a blow on the head produces vomiting, or a strong light sneezing.

Sympathetic irritation may be more or less direct;

as where the lungs and stomach (receiving their nervous supply from the same source) are affected sympathetically; or when the skin and mucous membrane are similarly influenced.

General nervous irritation may be idiopathic or *apparently* spontaneous, as in chorea and other nervous affections; or the cause of irritation may be palpable though distant, as where a wound is succeeded by tetanus, or a broken leg by delirium.

A local injury may be followed (1) by healthy REACTION, which is temporary; this requires no treatment. Or (2) it may be followed by excessive reaction, endangering or destroying life; this demands control according to circumstances, such as purgatives, cold to the head, local bloodletting, sometimes opium, rarely general bloodletting. Or (3) there may be entire absence of reaction, death occurring sooner or later from SHOCK; this condition is to be met by the employment of warmth to the surface, friction, and the cautious use of stimulants. Or (4) protracted irritation may follow at a later period, constituting sympathetic or irritative fever, and demanding treatment according to the special requirements of each case, as by support, stimulants, and sedatives.

General irritation, the consequence of injury or operation, is sometimes reflected on the seat of lesion, inducing a morbid instead of a reparative action, and thus giving rise to phlegmon or otherwise endangering the vitality of the part affected. This condition occurs chiefly in unhealthy constitutions, deteriorated by dissipated habits, therefore of feeble power, but great susceptibility.

It may be assumed as an axiom, that irritation is augmented in intensity, usually, in proportion to deficiency in power. This constitutes a marked distinction between irritation, which has its seat in the nervous system and excited vascular action or inflammation. The method of affording relief is correspondingly distinct. In the one it is often necessary to relieve vascular repletion; in the other, soothing and tranquillising remedies are required.

Nervous delirium may be the consequence of a local irritation—any injury—acting on the cerebro-spinal centre: this occurs most frequently, but not necessarily, in drunkards. It is ushered in by an unnatural cheerfulness, with affected courage and indifference; bright eye; quick, involuntary movements; then occasional incoherence and sleeplessness, followed by insensibility to pain and wild delirium. There is usually profuse perspiration, but absence of fever, marked by a clean tongue and quiet pulse. When this condition occurs in drunkards (delirium tremens), there is general muscular tremor, anxiety, lack of appetite, nausea. In nervous delirium, the mind seems to be abstracted from surrounding objects of sense, and to hold intercourse with imaginary persons, and to be acting a part amid imaginary scenes.

This condition is rarely fatal, and is to be treated by repeated doses of opium, either by the mouth or rectum, until sleep be procured; from which, if profound, the patient usually awakes in a sane state. Stimulants must be used discretionally. Digitalis, in large doses, has been given with success.

Tetanus is another form of nervous irritation, dependent frequently on a local injury, which, acting on the cerebro-spinal centre, produces, by reflection, more or less general muscular spasm. These are essentially excito-motor phenomena. If limited to the muscles of mastication, which are usually first affected, the disease is called trismus. Emprosthotonos, opisthotonos, pleurothotonos, are terms employed severally to denote spasm of the back, front, or side of the trunk. The traumatic causes of tetanus may be any form of wound—most usually contused or lacerated wounds—sometimes of very trivial magnitude or importance, such as even a bruise; it occurs not infrequently after gunshot wounds, and may follow burn. Tetanus has been known to succeed various operations, as amputation, castration, deligation of an artery, hydrocele; but such cases are very rare. The interval between the receipt of injury and development of the disease varies from a few hours to many days. Trivial causes excite a paroxysm; the aspect of the patient is then very distressing. Death occurs from exhaustion, asphyxia, or possibly spasm of the heart. The intellect is unaffected, except just at the last in some protracted cases. Post-mortem examination shows congestion of spinal cord and of lungs.

Treatment.—Relieve constipation; draw off the water if retained. Perfect quiet should be enjoined. Soothe the seat of injury. The following medicines have been given in this disease:—Opium in repeated doses. Extract of belladonna, two or three grains every three hours. Same dose of Indian hemp at short intervals, till its narcotic effect is produced. Tobacco, in infusion, as an injection. The above are powerfully sedative. Aconite and strychnia have been recommended on an opposite principle. Chloroform given at intervals, or continuously for a lengthened period, is a valuable remedy. Sesquichloride of iron is valuable as a tonic. Division of nerve may be practised, by transverse incision above a wound. Amputation is not justifiable in most instances. Tetanus may become chronic, and then requires purgatives and tonics.

Constitutional irritation from absorption of morbid poison, as in hydrophobia and dissecting wounds (to be noticed presently), is very closely allied to that in tetanus and nervous delirium.

Fever may occur in connection with injury, operation, or surgical disease: it is then said to be symptomatic, or irritative or inflammatory fever. The type and degree of intensity of such fever are dependent on the character of the injury, the period of its endurance, and the importance of the tissues involved; also, intrinsically, on the previous health and habits of the patient, and on his age and temperament.

It is ushered in usually by shivering, followed by heat of skin, quickened pulse, thirst, foul tongue, disturbed secretions; pain in the head, and irritable stomach. This may be *continued* fever for a protracted period; or may assume the typhoid type, when there is feeble power and the source of irritation is unrelieved.

Symptomatic fever is usually asthenic in its type, and requires corresponding treatment.

Hectic is commonly present where suppuration is profuse and emaciation considerable. The periods of exacerbation are usually noon and evening. Appetite and digestion are good. The attack is ushered in by chill, then heated hands, flushed cheek, hurried breathing and cough, perspiration abundant towards morning. Tongue clean, thirst, eye bright, mouth aphthous at the last.

Treatment.—Nutritious diet, fresh air, cooling drinks, soothing medicines.

In fever it would appear that the temperature of the blood is raised; and the intensity of the fever is probably proportioned to the rise in temperature, the rigor marking the commencement of this change.

FUNCTIONAL DISTURBANCES IN THE VASCULAR SYSTEM, AND THEIR SEQUENCES.

The phenomena of inflammation have their proximate seat in the vascular system. The blood is compounded of various elements, endowed with chemical affinities, possessed of vital properties, and subjected in its circulation to mechanical influences. The direct mechanical agents in the propulsion of the blood are muscular contraction and elasticity. The phenomena of nutrition, growth, and repair, or of disorganization and destruction, are more directly in association with the capillary or intermediate system of vessels; whilst the augmented activity or increased energy of the propelling agents is entirely secondary, and dependent on the antecedent loss of balance in the capillary network, the arteries and veins holding the relation of intermediate conduits between them and the heart.

In health, the due balance of waste and supply is preserved, yet the operation of efficient causes may, without constituting disease, induce an extraordinary or diminished supply of blood to a part, and the corresponding consequence of excess in growth or the reverse; as in muscle when much taxed or disused. But there are other ways in which the balance may be suspended or lost; in which a large quantity of blood may be accumulated at any given point: this is "Hyperæmia." Such hyperæmia may depend on two distinct mechanical causes—one in which the accumulation is the consequence of some obstruction to the return of the blood through the veins towards the heart; the other in which it is conveyed to a part in increased quantity through the arteries. These two conditions are severally denominated passive and active hyperæmia.

PASSIVE HYPERÆMIA, OR CONGESTION, is the effect of mechanical obstruction, as where a vein is compressed or plugged. The consequence of such venous obstruction is distension of the capillaries, and, if continued, infiltration of tissues from excessive exudation of liquor sanguinis. Thus œdema or local dropsy, ascites or abdominal dropsy, and anasarca or general dropsy, are produced. In this filtering process through the porous vessels the nutritive quality of the liquor sanguinis is modified by changes in the proportion of albumen and salts; so that, although the quantity of blood actually present in a part so affected is unnaturally large, it is blood despoiled of its nutritive and stimulating properties, and therefore valueless for growth. Thus, congestion is an atrophic condition; and its effect is the same as where there is simply a deficient supply of nutrient blood, without detention; as proved by the feebleness of muscular tissue, which is the seat of such congestion, the occurrence of ulcers in varicose limbs, &c.

As, in passive hyperæmia, there is retention of deteriorated blood, so, in *active hyperæmia*, there is an increased supply of fresh and nutrient blood. Such augmented supply may, however, be attended by obstruction, primarily and principally, in the capillaries. It is this last characteristic which distinguishes inflammation from HYPERTROPHY; in the latter there is excessive nutrition, but unattended by obstruction. Thus, the quantity of blood is augmented in a part which is the seat of congestion, or inflammation, or hypertrophy. In the first there is obstruction in the venous circulation, and the blood is impoverished; in the second, there is obstruction in the capillaries, and the blood is nutritive; in the third, there is no obstruction.

ATROPHY, or deficient nutrition, may be local or general, and may be the consequence of disuse of the part affected, of congestion, of obstructed arterial circulation, of mal-assimilation, or of defective innervation.

ANÆMIA is used in a more restricted sense, to denote a general bloodless condition, resulting either from large or repeated loss of blood, or from some defect in the production of its constituent elements.

INFLAMMATION. — The capillaries, which take a most important part in the phenomena of *inflammation*, occupy an intermediate position between the extreme arteries and veins, and are constructed of a simple membrane of extreme delicacy, through which the liquor sanguinis is permitted to transude for the purposes of growth and reproduction: beyond this passive office, the removal of effete matter, and the power they are endowed with, of extending themselves by offshoots into new tissues, they take no active part in growth; such tissues growing by their own intrinsic power of development in their own germs.

Arteries are both muscular and elastic, and therefore capable of contraction and dilatation; veins possess the same properties in a very minor degree.

In health, the blood moves through the capillary network in an even uniform stream. Local irritation produces a disturbance in this uniformity, and subsequent arrest of the blood corpuscles; such stagnation resulting either from an altered condition in the vital relations between the vessels and their contents, or from the affected tissues sucking out an inordinate amount of nutrient material. Thus, the first observable sign of inflammation is capillary stagnation, concurrently with transudation of the liquor sanguinis. The immediate consequence of this exudation, but essentially secondary, is an increased supply of blood to the part;—degeneration of texture and active textural productiveness coexisting as essential conditions of inflammation. Increased supply of blood implies corresponding augmentation in the calibre of both arteries and veins, and their consequent relaxation; there is diminished resistance to the ingress of blood, and the vessels therefore become enlarged and distended. As reparation and reproduction proceed, the capillaries extend themselves into the new tissues; and, finally, the supplying and returning vessels resume their normal calibre, when the local requirements for augmented supply cease, *i. e.* when the inflammation subsides.

The *Signs* of inflammation are redness, swelling, heat, and pain. *Redness* is due to the accumulation of blood in the relaxed and distended blood-vessels. The intensity of colour and its hue depend on the degree of distension, and the preponderance of arterial or venous repletion. It is not confined to the immediate seat of inflammation; it is removable for the time being by pressure, and is thus distinguishable from discoloration by extravasation of red corpuscles. The presence of new capillaries also adds colour. The brighter the hue, generally speaking, the more active is the inflammation.

Swelling varies according to the laxity of the tissue affected. Taken alone it is valueless as a sign of inflammation. Its presence, in this condition, appears to depend on accumulation of blood, on infiltration from exudation, or on excess of new growth. Parts in the neighbourhood of inflammation are involved in this condition.

Heat is a somewhat deceptive sign, being more apparent than real, as proved by the thermometric test. Morbid nervous sensitiveness exaggerates the feeling to the patient. Yet, heightened temperature is present in inflammation, and appears due to the abundance of blood in circulation in the part, and the more active evolution of heat from the correspondingly active chemical changes. Experiment has shown that the focus of inflammation is warmer than the arterial blood in its progress to such part; and that the latter has also a lower temperature than the returning venous blood.

Pain may exist in varying intensity and kind, or may be altogether absent. Natural sensitiveness of a texture, and the unyielding character of surrounding tissues, modify this symptom. It may be intermitting or continuous; and may be excited by pressure or motion. In acute inflammation it is usually throbbing, plunging, or lancinating. Dense and closely confined textures are generally the seat of the severest pain. The character of pain is often a valuable diagnostic sign of the stage of inflammation; and various explicatives are employed by patients to define their suffering, such as pricking, burning, stabbing, cutting, or gnawing. Tenderness is pain induced by pressure. Pain may be sympathetic and at a distance from the seat of inflammation, as that in hip-disease referred to the knee. Sudden cessation of pain may indicate the suppurative or gangrenous termination of inflammation. The pain of inflammation is due to pressure, or stretching, or actual organic lesion of the nervous fibrillæ; and is distinguishable from simple neuralgia by the absence of the other signs of inflammation, and by the latter being almost invariably intermitting or periodical.

The *Causes* of inflammation may be classed under two heads—exciting and predisposing; or both may be combined. The exciting causes may be mechanical, chemical, extremes of temperature, the circulation of a poison, the proximity of disorganized or dead tissue. The principal predisposing causes are, defective innervation, deteriorated or obstructed circulation, hereditary diseased tendencies, atmospheric and allied external influences.

The *Changes* which occur in the transuded fluids in inflammation must not be confused with those which are consequent on congestion. Both the physical causes of the effusion and its chemical constitution are different. The quantity of inflammatory effusion is influenced by the natural vascularity and the looseness of the affected textures, and therefore is not to be taken as a measure of the intensity of the inflammation. Its physical characters also vary; it may be colourless, limpid, turbid, or mixed with blood. Its specific gravity is high; and, besides the presence of organic forms derived from the dissolving tissues, inflammatory exudation may be further distinguished chemically from dropsical effusion by an excess, even over the blood, of chloride of sodium and the phosphates, as well as by the presence of albumen in sufficient quantity to coagulate with heat. Cells, in various grades of development and in varying quantities, of which the pus-cell is the type, are also present. These products indicate the coexistence, in an inflamed tissue, of rapid decay and death, with abnormally increased productiveness and growth.

Treatment.—In treating inflammation, remove, if possible, the exciting cause, or mitigate, as far as may be, its effects. An accurate knowledge of the pathological condition will lead to the employment of sound treatment, on rational and intelligible principles. It is to be borne in mind that inflammation is essentially reparative, and therefore that its course and consequences are not to be opposed, so much as controlled, directed, and modified.

Rest should be enforced, *e. g.*; in a broken limb, a diseased joint, after operation for hernia. Posture should be such as to favour the return of blood towards the heart. *Depletion* may be local or general; as by leeches, punctures, sudorifics, purgatives, &c. *Counter-irritation* by blister, moxa, &c., to a neighbouring part. *Topical applications*, viz., cold, warm, and anodyne. Heat and cold produce similar results in a different way; the former encourages free exhalation from the skin, the latter acts as an astringent on the vessels, and thus limits transudation from them. The former is generally preferable, as more continuous in its operation. *Surgical operation*, as in phlegmon, abscess, extravasation of urine. *Diet*, to be regulated by circumstances.

The special application of these general principles embraces a large proportion of surgical practice.

CONSEQUENCES OR TERMINATIONS OF INFLAMMATION.

Inflammation may run its course, and subside without leaving any trace of its existence: or it may entail one of two sets of consequences—the deposit, and perhaps organization of new product; or a loss of substance by a gradual and wasting process, or by actual and rapid death of the part. Such loss may take place, in other words, by softening down into pus, by ulceration, or by gangrene.

In RESOLUTION the capillary obstruction and arterial repletion subside, a healthy equilibrium between the afferent and efferent vessels is restored, and the effused liquor sanguinis is absorbed, leaving no organic change behind. Mild erysipelas, trifling scalds, &c.,

illustrate this condition. In some instances congestion accompanies or follows inflammation tending to resolution. *Treatment* must be directed to limit such inflammation and induce its resolution, as by evacuants, rest, posture, warmth or cold.

Suppuration, ulceration, phagedæna, gangrene, are all modifications of the same distructive process by which the living organism becomes effete and is given over to chemical dissolution. Thus, abscess is a closed and shut-in ulcer, and ulcer an open abscess on the surface. Phagedæna is rapid ulceration; so rapid that the effete matter is undissolved in the pus, and clings to the surface. Gangrene is more or less sudden death falling on a part, involving various textures simultaneously.

Ulceration is a devitalizing process, by which a breach of surface is produced, in consequence of the softening down, under chemical decomposition, of the heretofore living textures. New chemical affinities being established, fresh combinations result, and oil especially is found in place of albumen and gelatin. But, as the process is, in a varying degree, inflammatory, the presence of reproductive effort is apparent in the discharge, in the form of unappropriated cells and corpuscles, including those of pus. Ulceration presents every grade, and corresponding variety in its attendant phenomena, between the almost imperceptible extension of a breach and rapid phagedæna bordering on gangrene.

Treatment.—By rest, soothing applications, warmth and moisture, detergents, stimulants, escharotics, &c., according to circumstances. The details will be given, with ulcers.

Pus is found on the surface of ulcers, of mucous and other membranes, and contained in circumscribed cavities. Microscopically, pus consists of a multitude of cells, about $\frac{1}{2000}$th of an inch in diameter, with a nucleus, and containing within its translucent walls albuminous matter. Other globules and cells, mingled with pus on a suppurating surface, represent the spoiled material for growth.

Abscess is a disorganizing inflammation of texture beneath the surface, presenting the essential phenomena of ulceration, but modified by circumstances of position and texture. Thus, the products are confined within a more or less limited space. The loss of substance is not to be measured by the size of an abscess The tendency of such purulent accumulation is to. evacuate itself by the surface, or into some neighbouring cavity.

Symptoms.—Pain, swelling, fluctuation. Abscess may be acute or chronic, with many intermediate conditions. The purulent contents vary according to circumstances, being thin, thick, bloody, or fetid.

Treatment, local and general.—Rest, position; leeches; cold, or warmth and moisture. The time for opening is earlier where density of texture resists approach to the surface, or where there is risk of penetration in other directions involving important tissues, as in the perinæum. Handling should be avoided, as well as admission of air, by which the contents of an abscess are subjected to decomposition. Large, chronic abscess should be treated by repeated openings, and uniform pressure in the intervals. Pus is transferred, apparently, in some instances, from one part to another. Abscess, consequent on poisoned blood, is probably eliminative. Sympathetic abscess may result from simple irritation or from the absorption of poison, as in bubo. Pus may be diffused through the areolar tissue, or amongst muscles; it should then be evacuated early.

A *sinus*, following abscess, is the consequence of defective action or some mechanical obstacle, preventing a cavity from completely closing. The secretion is usually thin and abundant, often accumulating for want of ready exit.

Fistula is a sinus in connection or communication with some natural excretory duct.

Treatment. — By pressure, stimulant injection, caustic probe, or free incision, dressing the wound from the bottom.

Hectic is a frequent concomitant of suppuration in weak and irritable constitutions which are overtaxed by the reparative effort.

MORTIFICATION, as a consequence of inflammation, is purely destructive; thus differing from ulceration and abscess, which, though also essentially destructive with varying rapidity, are attended by an abortive effort at reparation. Gangrene may be dry or moist, according to the rapidity of the devitalizing process, the character of the tissue involved, the scantiness or abundance of the areolar tissue, and the quantity of moisture in a part. The earliest symptoms indicate intense inflammation; the colour is dark, the heat burning, the swelling hard. The skin next assumes a yellowish or bruised appearance; the temperature declines, and vesication occurs with effusion of dark fluid. Then pain diminishes; the parts shrink and turn to a brown or ashy colour, with fetor; lastly, they become black, cold, and insensible. The general symptoms are, first, in slow but fatal cases, excitement of the circulation and fever; subsequently, those of shock. Face cold, pale, and moist; features pinched; pulse quick but feeble; tongue brown; collapse, vomiting, hiccup, muttering delirium, earthy odour from the body; death.

The constitutional symptoms are much modified according to circumstances of extent and cause of gangrene.

General causes. — Feeble power with irritability, either natural, induced by fevers, or by other depressing agents; poisons inhaled (as in hospital gangrene), or introduced into the circulation (as in bites of venomous serpents); also defective assimilation or nutrition; ergot of rye.

Local causes.—Insufficient circulation or innervation; pressure, as in bed-sores; contused and lacerated wounds; tearing across or ligature of a large artery; arteritis or obstructed arteries from ossification, (senile gangrene); isolation of a part, as after plastic operations; excessive, or deficient heat; escharotics, as acids, lime, &c.

Treatment.—General, according to circumstances, such as cause, condition of system, and stage of disease. Support and tranquillise; bark, ammonia, opium, wine. Local; various stimulating poultices, such as stale beer-grounds or carrot; charcoal; chloride of lime or nitric acid washes. Remove sloughs as they are loosened. The period for amputation must be determined by the original cause of mortification; when purely local, and the effect is limited, it may be resorted to early; where the cause is general or constitutional, the arrest of the destructive process, as indicated by a line of demarcation, must be waited for. Spontaneous separation of a mortified part is accomplished by an ulcerative action, and not by absorption.

BOIL AND CARBUNCLE.—*Acne* is the simplest form of boil, being suppuration excited by the accumulation of secretion in a sebaceous follicle of the skin. Friction of the affected surface is the best preventive.

Boil and carbuncle are closely allied, both commencing usually as circumscribed inflammation of the skin, and subsequently extending more or less deeply. They are often combined; and the causes producing them are the same, though modified in degree.

In *furuncle* or *boil*, the condition is allied to abscess, the cutaneous inflammation terminating in circumscribed suppuration. In *anthrax* or *carbuncle*, the inflammation terminates in plastic infiltration of the areolar tissue, and rapid disorganization. Probably, in each the action is eliminative. The predisposing causes are insufficient or excessive nutrition, low power of assimilation, inaction or disordered function of liver, kidney, &c.: diabetes; gouty diathesis. The parts most usually attacked are, the nape of the neck, between the scapulæ, the buttock, or the shoulder:

but any part of the body may be the seat of these affections, which are very liable to recur, especially when interfered with surgically at an early period.

Treatment.—Careful attention to secretions, nutritious diet, suitable stimulants. Pressure, or the application of iodine paint may arrest carbuncle at an early period. Subsequently, use warmth and moisture. Premature incision is to be deprecated. Small but deep incisions where pus begins to exude, to give exit to it and to sloughs, are preferable to large incisions, unless the mechanical tension imperatively demand the latter. Then apply stimulating poultices; and support with adhesive plaister as soon as the sloughs have separated.

ERYSIPELAS is diffused inflammation of the skin alone, or involving the areolar tissue, accompanied by fever. It is probably an atmospheric poison and infectious; its duration varies. It occurs most frequently in constitutions naturally feeble, or broken down by previous disease or excess; and is more common in youth and middle age, often indicating an inherent predisposition on the part of the patient. It may recur repeatedly and coexist with other diseases. The exciting *causes* are sometimes trifling, such as a slight wound of the scalp or scrotum, a leech bite, &c.; also any surgical operation. The general *symptoms* which usher in the attack are those of fever, viz., rigor, flushed face, foul tongue, quick pulse. A scarlet blush then appears, accompanied by some tumefaction, and spreads with more or less rapidity. The terminations are, as in ordinary inflammation, according to the type of the attack, which may be that of simple, œdematous, or phlegmonous erysipelas. In the first form the inflammation is limited to the skin (erythema); in the second the areolar tissue is involved, and there is always more or less infiltration of it from exudation; these forms usually terminate by subsidence or resolution. The third or phlegmonous form frequently runs a destructive course, terminating in diffuse suppuration and sloughing, and often entailing a fatal issue. In the milder forms of erysipelas, vesication is usual, and occasionally circumscribed abscesses form where the areolar tissue is lax and abundant, especially in the eyelids. The scalp rarely sloughs after erysipelas, probably because of its high organization; and the scrotum and lower extremity do so most frequently.

Treatment.—General, as in ordinary inflammation, according to the cause, constitution, and existing condition; but remembering that the disease is generally indicative of an asthenic state. Light nutriment, wine, bark; opium if necessary, but with caution. Attend to the secretions.

The local treatment in the mild forms should be very simple, such as light poultice, water dressing, or evaporating lotion. In erratic or spreading erythema, a free use of nitrate of silver to the skin, beyond the seat of attack, will often arrest its progress; but it is of little value where the areolar tissue is involved. Leeches or punctures are rarely of any use, but often mischievous. When the phlegmonous form is accompanied by great tension, or there is evidence of diffused or circumscribed suppuration, then incision should be resorted to. Such incisions should rarely exceed two inches in length, but they must be deep enough to divide freely the areolar tissue down to the subjacent fascia in a limb; superficial incisions do no good. Regard should be had to the neighbourhood of large vessels; and hæmorrhage should be controlled by a compress of lint in the wound. Separation of sloughs of areolar tissue and fascia, should afterwards be encouraged by warm applications. The skin rarely perishes in this form of inflammation.

HOSPITAL GANGRENE, or gangrenous phagedæna, is essentially constitutional in its origin, dependent on an atmospheric poison absorbed into the system, and occurring principally in crowded, ill-ventilated hospitals or camps: it belongs to the same category as traumatic erysipelas.

It is ushered in by rigor, foul tongue, excited circulation, hot skin, &c.; and accompanied by great prostration and irritability. The ulcer or wound which it attacks becomes covered with viscid, ash-coloured slough, and surrounded by a vivid red blush. The circumference vesicates and ulcerates rapidly, and the chasm deepens. The neighbouring absorbents become inflamed. An allied condition is not infrequently met with in patients, mostly females, suffering from syphilitic ulcer or bubo.

Treatment.—Generous diet, stimulants, bark and ammonia: strong nitric acid applied to the surface, and repeated if necessary: stimulating poultices, as stale beer-grounds. Above all, pure air and cleanliness.

ULCERS.—Ulcer is the condition consequent on ulceration as the action: thus, every patch of ulceration is an ulcer, and, whatever its duration, is the consequence of the same proximate cause, and is to be treated on the same general principles. These general principles are based on a proper understanding of the various conditions of the circulation in congestion and inflammation, and their resulting tendencies. The most usual seat of ulcers is the leg below the knee.

Causes.—The exciting cause of ulcer is often so trivial as to escape notice, when acting on a limb or part predisposed to ulcerate. This predisposition, locally, consists in chronic congestion or venous obstruction in the smaller vessels, often, but not necessarily, associated with varicosity of the larger veins: and this condition is favoured by the erect posture constantly maintained; by heat, as in cooks; by obstruction of venous circulation, arising from habitual constipation or from pregnancy. The skin is sometimes thick and mottled, at others white, shining, and œdematous, or showing patches of injection on the surface. In this lowered state of vitality, a slight lesion of surface, instead of healing, ulcerates; or a little spot of superficial ecchymosis precedes this result; or the first step may be quite spontaneous by vesication.

The circumference of such spot then becomes angry and inflamed, and ulceration spreads. Apart from specific causes, as scrofula, syphilis, &c., the constitutional or predisposing causes of ulcers are, as in other destructive forms of inflammation, an overloaded state of circulation, combined with disordered functions of assimilation primarily and of circulation secondarily; or debility from over-taxed powers and deficient or defective food: an enfeebled system after disease, such as fever, predisposes to ulcers, which then result from even trifling exciting causes. Ulcers are sometimes vicarious of suppressed catamenia, or other habitual discharges.

The simplest division of ulcers is into acute and chronic. Either may be converted into the other; the former by time, the latter by sudden and active extension.

Acute ulcer is characterised by a tendency to spread, being usually recent; and it may thus become phagedænic or gangrenous: it may spread superficially or deeply, and is accompanied by great pain, unhealthy discharge, and inflamed circumference with œdema.

Treatment.—According to circumstances; soothe, support, attend to secretions, &c. Rest, favorable position, soothing or detergent applications, as the case may demand; water-dressing; poultice.

Chronic ulcers are usually irregular in form, more or less excavated; and, when indolent, of a dull red or pale colour and glazed appearance, with white, elevated and irregular callous edges, and pouring out a scanty and thin discharge. A common position for them is over the ancles, or on the front or side of the leg. Chronic ulcers may be indolent or active, and this activity may be shown by a disposition to spread or to heal. When spreading, the surface is foul or even sloughy; when healing, healthy florid granulations cover the surface, and yield a creamy discharge. The treatment of chronic ulcer must be determined by its condition. Horizontal position and rest are important elements. Strips of wet linen, and over them a bandage carefully applied from the foot to the knee, when the leg is the seat of ulcer, serve to afford uniform support to the circulation. But first of all, the foul surface must be cleansed by stimulating lotions beneath poultice or water-dressing, such as black-wash, chloride of lime, &c., or a single application of strong nitric acid; poultices of yeast, charcoal, or carrot. Red mercurial ointment, under a roller, suits some ulcers. Callous edges should be pared, or destroyed with caustic.

Besides the above simple division of ulcers, the following modifications may be mentioned:—The *irritable* ulcer, which is usually small, circular, irregular, not deep, with inflamed circumference and thin discharge. The pain accompanying this form of ulcer is sometimes very severe, and quite disproportioned to the magnitude of the wound. It is usually of long standing, and difficult to treat. Black-wash, with mucilage and opium, may be applied under poultice. Support, and even firm pressure, often relieve.

The *catamenial* ulcer is usually circular and superficial, and yields a vicarious menstrual discharge.

Varicose ulcers sometimes commence by the bursting of a vein, or they subsequently are prone to bleed. Rest and support are then imperative.

Much caution should be exercised in healing old ulcers rapidly, if they be so disposed, as head symptoms or internal hæmorrhage may supervene.

THE HEALING PROCESS.

The nature of the healing process depends upon the condition of the wound or lesion to be healed; and it is only in those injuries of textures, which are unattended with loss of substance, that the reparation can be effected without reproduction of material. Further, the healing process varies materially according to the tissues which are lost, or injured, or divided, such as skin, muscle, bone. These details will be noticed in association with the "Injuries of various textures." The present remarks will be limited to the healing of divided tissues by adhesion, and breach of texture by granulation. The union of a simple fracture of bone requires the production of new material to cement the broken ends together, even when there has been no loss of structure; and probably this is the only instance in which such new material is strictly identical in texture with the original.

The vascular activity and its attendant symptoms, in a healing part, are essentially the same as in inflammation, but the difference is in degree and results; the process, in healing, is purely reparative. The true elements of growth, and therefore of reparation, are, as already stated, a solution of the salts of the blood, containing albumen mixed with fibrin in varying proportions; and various textures possess the remarkable property of selecting the requisite materials for their own reproduction or repair.

The basis on which adhesion depends is fibrin, poured out in solution, and subsequently converted, by coagulation, into a colourless, homogenous mass; by this the adjoining surfaces of a wound, unattended by loss of texture, are mechanically agglutinated together, whilst the serous menstruum escapes from the breach. Probably this fibrin is not organised; as fibrin, *per se*, exhibits no special tendency to organisation; but it forms the bed through which capillary offshoots pass between adjoining surfaces. When the vascular union is complete, the fibrin is removed by absorption. Where there is loss of texture the process is similar, but modified by the mechanical difference in the circumstances of the wound. After bleeding has ceased serous exudation continues, accompanied by increased vascular action. The fibrin is deposited, and gradually coagulates until the surface of the wound assumes an uniform glazed appearance. Into this, in the course of time, vessels shoot; pus is secreted (the superfluous material of reparative growth), and the vessels form the tufted cones in the fibrin, called granulations. Then the condition of the wound is identical with that of a healing ulcer, or the interior of an abscess; and the further steps are the same in all. As the production of new material, by cell-growth, goes on and becomes organised, so, *pari passu*, the old fibrin is removed, and fresh is thrown out to form the bed of new tufts of vessels; the pus meanwhile protecting the surface. The surrounding level is thus gradually gained, and then roofed over with skin. The cavity of an abscess, from which pus has been discharged, is, in like manner, filled in until the sides coalesce by vascular inter-communication. The so-called pyogenic membrane would seem to be this granulating surface modified by circumstances. The contraction and loss of elasticity, following the healing of an abscess or breach of texture, are dependent on the non-reproduction of destroyed tissue, especially the areolar.

In the case of a sinus the difficulty in healing depends on its approximation, in its mechanical relations, to an unopened abscess, and the distance between its extremity and the skinning edge. The constantly accumulating secretion prevents the organic coalition of its opposed surfaces; especially where there is any movement, as in fistulæ. Therefore rest and pressure are useful, and the stimulation of the surface provokes more activity and the secretion of lymph; or incision puts the *edges* of a sinus, as well as its mouth, in free communication with the contiguous skin.

The skinning over of a granulating surface is effected from the circumference only of a breach; and this circumference should be healthy. A recent cicatrix possesses low vitality, and is thus obnoxious to fresh ulceration from exciting causes, which act less readily on original texture; as in scurvy, hospital gangrene, &c.

SECTION II.

OF WOUNDS IN GENERAL.

All *injuries* may be classed under three heads, mechanical, chemical, and from poison. Hæmorrhage is so common a consequence of the first, that its causes and treatment should be first considered.

HÆMORRHAGE may be external or internal; the former comes within the province of the surgeon. The effects of the loss of blood depend on the rapidity of its abstraction and its character. Faintness is consequent on the diminished supply of blood to the brain when the heart's action is enfeebled; this is Nature's styptic, allowing time for coagulation and the plugging of vessels.

Internal hæmorrhage results from the bursting of capillaries under excess of pressure or from feeble resistance; it is not transudation. It may be idiopathic, *i. e.* without apparent cause, as in epistaxis, or symptomatic, as from organic disease or congestion; further it may be active, as in the robust; or passive, as in the feeble; it may be also vicarious of menstrual discharge. These considerations must guide the treatment.

Hæmorrhagic tendency is noticed in some persons and families; thus, bleeding from the nose, the loss of a tooth, or a trifling wound has proved fatal. Internal hæmorrhage affects different organs at various ages; as the lungs in youth, the urinary and genital passages in middle age, and the brain in old age.

In active external hæmorrhage, an uniform stream and purple colour betoken venous bleeding; a rushing stream, especially when in jets, and a scarlet hue are characteristic of arterial bleeding. The two may be mingled. Arterial hæmorrhage more rapidly depresses the heart's action than venous.

Hæmorrhage is *primary*, as from wound; *reactionary*, after suspension from faintness, or other cause; and *secondary*, as from ulceration, or separation of slough or ligature. Venous hæmorrhage usually ceases spontaneously, without recurring; arterial hæmorrhage may do so likewise, in the following way:—The open mouth of the severed artery contracts and retracts; coagulum forms around and within it; its sides are subsequently glued together by effused lymph, and vascular union ensues. Hence, a partly divided artery bleeds more than one entirely severed. A torn artery bleeds less, because its outer or cellular coat, being tough, gives way last, and is thus elongated beyond the other retracted coats, forming a conical projection beyond them. When a large artery is wounded, it should be tied above and below the wound, as the distal extremity will bleed when the collateral circulation carries blood enough into it. (For more details, see "Injuries to Blood-vessels.")

Transfusion of blood into the veins is eligible, as a last resource, when there has been a large drain, and there is reasonable prospect of its not recurring.

Treatment.—Surgical hæmorrhage should be treated by rest, a position to favour the return of blood, a cool atmosphere, and security from all sources of vascular excitement; nutritious but unstimulating diet. Locally, astringent solutions; perchloride of iron; a stream of cold water, or ice. Compression of the supplying artery, or a sponge compress, wrapped in gauze, fixed firmly in a wound; uniform support of a bleeding limb; actual cautery. Torsion of small arteries, or a ligature applied on an isolated larger vessel. Of medicines, iron, gallic acid and lead, are the most usual and valuable.

MECHANICAL INJURIES may be inflicted with pointed, sharp-edged, or blunt instruments ; and thus we may have punctured, incised, or contused wounds ; or a wound may be produced by some object tearing the soft parts, and this is called a lacerated wound. These different forms of wound may be combined in one injury.

Simple *contusion* or bruise, without breach of surface, may result from a blow or pressure causing limited effusion of blood into the areolar tissue (ecchymosis), or larger extravasation, either diffused or accumulated. It is important to distinguish between such circumscribed extravasation and abscess ; for which purpose the sudden appearance of the former, absence of pain, &c., suffice. Such extravasation may give rise to suppuration. Simple contusion may be treated by evaporating lotions, or warmth and moisture; subsequently friction and support. Circumscribed extravasation of large extent will be absorbed in time. Never open such sac unless suppuration threaten ; if converted into an abscess by inflammation, it must be treated accordingly.

An *incised* wound should be carefully cleansed, and its edges adapted and retained with plaister, sutures, or pins, as required. It should then be kept cool. Alcoholic lotion favours union.

Punctured wounds are inflicted with pointed instruments, with either sharp or blunt edge. Such wounds being deep and their aperture small, the discharge is confined, and the troublesome consequences attending them are due to this cause, as in a sinus ; probably there may be also contused division of nerve-fibres. Constitutional irritation attending these wounds is often severe. Treat by rest, cool applications ; and, if there be much inflammation, by free incision, converting the punctured into an incised wound, to give free exit to the discharge.

Contusion, with breach of surface or *laceration*, is a torn bruise. These bleed less than incised wounds. If severe, sloughing may succeed, followed by protracted suppuration. Their healing is always tardy. Cleanse and soothe; first apply cold; when inflammation ensues, warmth and moisture, to favour granulation; then treat as ulcer. Try to save the skin and reapply it, using sutures if requisite. The risk of tetanus is greatest in these wounds.

Gun-shot wounds are from ball or shot. Small shot may enter or pass through a limb or other part of the body in a mass, if the distance be short; or the surface may be penetrated at numerous points, if the distance be greater. In either case, as far as practicable, remove the shot, and with them any extraneous matter. Promote suppuration by soothing applications. If the hand be the seat of injury, care should be taken to sacrifice as little as possible, and skin should be preserved to cover the surface exposed by partial amputation. It should be remembered, however, that these are wounds not unlikely to be succeeded by tetanus.

The wound from a ball is contused and penetrating, and prone to bleed freely in proportion to the velocity of the projectile. First, a numbed sensation is experienced, followed by acute pain, and subsequently prostration. The orifice by which a ball enters is smaller than that by which it makes its exit. Such double opening favours the subsequent escape of discharge. These wounds are, of course, complicated by the retention of the ball or of clothing. A gun-shot wound is said to be *simple* when the skin and muscles alone are implicated; *compound*, when a large artery is cut, a bone broken, or a visceral cavity entered. Yet, deep textures may be severely injured without breach of surface, as by contusion; or by the "wind of a ball," *i.e.*, the sudden vacuum caused by its near and rapid transit. A "spent ball" is dangerous, because a rapid axioid motion may, by striking any body, be converted into a projectile motion; thus a blow from a spent ball in the epigastrium has caused instant death. The general treatment must be conducted on rational principles, modified according to particular circumstances. When there are two openings, treat by rest and soothing, and by encouraging granulation and favouring discharge. When the ball is lodged endeavour to extract it, as in the case of any other foreign body. The position of the patient when the wound was received will serve as a guide to the direction the ball has taken; but wounds should not be needlessly dilated. Balls sometimes take a circuitous course, as round the body beneath the skin, or round the skull; they may then make their exit at some distant point. If left in, a ball may travel from spot to spot, or become encysted. When cavities are penetrated, it is generally vain and prejudicial to search for the ball; the treatment must then be as in other penetrating wounds of these cavities. (See " Injuries of regions.")

Wounds from *cannon shot* are necessarily severe. As regards amputation in such cases, instantaneous removal of a limb is regarded as the best practice, where the collapse does not forbid it; otherwise, wait for reaction. It has been remarked, in military practice, that secondary amputation is rarely successful. The ordinary rules of practice would appear to apply to these cases in most instances. Tetanus, according to military annals, appears to be very prevalent, apparently epidemic, in some circumstances; and in others, without assignable cause, it is scarcely met with.

Sabre and bayonet wounds are incised and penetrating wounds, and are to be treated severally as such.

POISONS are agents which either destroy structure, as escharotics; or produce disturbance of function, as many medicinal agents, in the body: and these effects are independent of mechanical violence or extremes of temperature. The subjects to be here considered are —(1) the action of chemical agents on the surface of the body; and (2) animal poisons.

Many *chemical* agents are employed to destroy diseased growth, or the foul surface of an ulcer; such as the strong mineral acids, and some metallic salts, as of mercury, zinc, antimony, potass, silver. Where so used, great caution should be exercised to limit their action, either mechanically or by antidotes. For immediate effect, either nitric acid or potassa fusa are best; for slower destructive agency, the metallic salts may be mixed with lard. Where injury from these has been inflicted accidentally, the only remedial means to be employed are diluents or a neutralising application. Treat the part afterwards for local gangrene.

Animal poisons taken into the circulation may be either the natural product of an animal, or the result of decomposition.

In our country there are some few insects which sting, of which the hornet is the worst; and but one reptile whose bite is venomous,—the adder. The puncture of the wasp's or bee's sting is accompanied by the injection of poison, which produces tingling pain, with inflammation in the part. Oil, ammonia, or laudanum, or two of them applied in combination, allay the burning pain. The most troublesome part to receive the poison is the mouth or throat. When there are many stings, there may be considerable constitutional disturbance. The viper's bite is rarely fatal: occasionally the effects of poisoning from tropical serpents is seen in this country; and the intensity of the symptoms does not appear to depend alone upon the quantity of poison injected. These symptoms are intense local pain, swelling and livid discoloration of the part, sickness and giddiness followed by vomiting, intoxication, and insensibility. Death occurs at varying intervals, from a few minutes to hours, or longer.

Treatment.—(1) Oppose the entrance of the poison; (2) strive to remove it; (3) support the vital powers. A ligature round the limb may arrest the poison, when limited to the veins and absorbents of the skin.

Suction by the mouth or a cupping-glass may withdraw it; or excision or caustic may be available at an early period. Brandy and ammonia in large doses constitute the most approved general treatment. Natives of tropical climates compound remedies from herbs, which are said to be antidotes to this deadly poison.

Morbid animal poisons may be received into the system through the lungs, or by inoculation. In the former class are numbered many contagious disorders; and the latter includes cow-pock; and also syphilis, to be noticed anon.

Hydrophobia probably never occurs sporadically. The source or vehicle of the poison is the saliva. The symptoms in the dog are—running straight with the head and tail down, and snapping at obstacles, restlessness in confinement, unnatural appetite, altered bark, suffused eye, frothy mouth, swollen tongue, exhaustion, constant snapping till death. Youatt says the shortest period of incubation is fourteen days; more usually five or six weeks elapse. Most animals may be infected if bitten.

In man, the interval from infection varies to many months. Pain occurs at the original wound; the cicatrix gives way. There is a sense of depression and dread; stiffness of the neck and throat; irritability of manner; dread of swallowing; the sight of water, a breath of air, or any bright object, produces a paroxysm. The intellect is affected, sometimes even to wild delirium, and death ensues usually in three or four days, or earlier. Youatt deprecates excision, because thereby the poison may be diffused, but has perfect reliance on nitrate of silver, a pointed stick of which should be plunged, as soon as practicable, to the bottom of the wound. This should not be neglected after time has elapsed; but if the wound be healed, the cicatrix should be excised and caustic then freely applied. General treatment, where the disease is developed, is probably of little avail. Chloroform may be inhaled, or opium exhibited, to tranquillise and soothe.

Absorption of poison, generated in *decomposing* animal matter, usually occurs in dissection, or to cooks in preparing high game. The consequences of such wounds are divisible into those which expend themselves locally, and those which affect the system generally; and these consequences are often, if not most commonly, developed in an inverse proportion. Punctures or scratches more often entail mischief than incised wounds. An inflamed lesion of surface does not so readily absorb poison as a recent abrasion or wound. The health of the recipient greatly influences the result; but full-blooded, healthy persons are by no means exempt. The local effects are tingling and itching, followed by throbbing pain; absorbent inflammation; suppuration at or near the seat of injury, sometimes deep-seated, or in the course of the absorbents, or in the lymphatic ganglia. Wandering erythema may spread around the wound, or phlegmonous inflammation may ensue; constitutional disturbance is also present, but varies much in intensity.

If *general* symptoms first appear, and speedily, absorption of poison into the system is denoted, and its circulation is indicated by shivering, headache, vomiting, general nervous irritation, small, quick pulse, hurried respiration, anxious countenance; then, reflected irritation, and inflammation at the seat of injury, perhaps running speedily into mortification. Patients die, usually delirious and typhoid.

Treatment.—It is desirable always to convert a punctured wound of this sort as soon as possible into an incised wound, and to encourage bleeding. Then soothe by employing warmth and moisture. Leeches may be applied along inflamed absorbents, if there be much tenderness. Incise early and deeply where there is local tension or suspicion of the presence of pus. Tranquillise nervous irritation with anodynes, and give a sustaining, and even a stimulating diet. Gentle, alterative aperients should not be neglected. In the severer constitutional form of the disease, opium, ammonia, bark and wine must be used at discretion, as the prostration and nervous excitement are great. Change of air is a valuable aid when the condition of the patient admits of it.

In some instances a train of analogous symptoms, accompanied by severe, and perhaps fatal, phlegmon, is the consequence of some trivial accident, such as the scratch of a rusty nail, as the exciting cause. But such results ensue only in persons of vitiated constitution or deteriorated health. Probably the explanation of these phenomena is, that local morbid changes or decomposition generate a poison at the seat of injury; and thus the circulation generally becomes impregnated, as where foreign animal poison is introduced. Analogy forbids our believing that a metallic, or even vegetable, poison, can produce identical contagious results.

EFFECTS OF HEAT AND COLD.—The extremes of temperature produce similar effects upon the body. Severe burn and frost-bite destroy texture; and the reaction following reduced temperature is a condition closely allied to the immediate effects of heightened temperature.

Chilblain appears to result from repeated alternations of temperature, producing congestion first, followed by a low form of inflammation. Pain, redness, heat, and swelling are accompanied by a tingling and itching sensation, sometimes terminating in superficial, indolent ulceration. The parts affected are usually the toes or fingers. Warmth and stimulating embrocations in the early stage, and suitable applications to an indolent ulcer, if there be such, constitutes the treatment.

Very low temperature suspends vital action; and if prolonged, this suspension is permanent. The part thus affected is said to be frost-bitten, and is pale, insensible and shrivelled. Reaction should be moderated; thus friction with snow is employed. After reaction, soothing, warm applications should be employed. If irrecoverable, the part should be treated as in ordinary mortification. Destruction may be immediate, or the consequence of excessive reaction. Cold winds act by the continuous abstraction of caloric from the parts subjected to their influence.

Excess of temperature over the natural standard may be borne, within certain limits and under certain conditions, without injury. Evaporation from the skin protects it when surrounded with air heated to a high temperature; the hand may be placed over a jet of high-pressure steam; or a wet hand may be plunged with impunity into molten metal, probably because protected by the vaporized fluid.

Scalds are produced by liquids at high temperature; those from oil are severe. The cutis is rarely destroyed. Generally the condition is identical with that of slighter burns; redness, vesication, &c.; to be treated in the same way. Scalds of the throat and mouth are dangerous if the glottis be involved.

Burns, when slight, are followed by vesication. Acute suppurative inflammation of the cutis may succeed, without its destruction; but the more severe action of heat may destroy the cutis, which then has a gray or brown hue, or charred appearance, usually with defined margin, readily distinguishable. The amount of constitutional disturbance varies in proportion to the extent of surface implicated, and is more severe when the trunk is affected. The shock of a large superficial burn or scald is very great, and often fatal, from collapse without reaction.

The indication in superficial burns is to supply the lost protection of the cuticle, which may be done with rags steeped in oil and lime-water, or with a mixture of chalk, vinegar, and oil, or with cotton wool. Vesications should not be unnecessarily meddled with; only to relieve tension. Reaction should be encouraged cautiously, and watched. The state of the chest and abdomen should also be watched, as fatal inflammation may ensue. Opium is valuable to allay pain. In destruction of the cutis the local treatment must be as in mortification: no specific remedies are needed. The general treatment must be the same as in large superficial burns. If the early shock be survived, the patient may afterwards sink under the exhausting suppurative stage, in spite of support. Great caution must be exercised in the healing of such wounds, to obviate the disastrous consequences of contraction, as in the neck, armpit, elbow, &c. This is to be accomplished by position and careful dressing. Ulceration of the duodenum, which is met with after burns, is either metastatic, or the consequence of vomiting accompanying the attendant shock and nervous irritation.

Contraction following the healing after burn may be relieved by operation, although the permanency of the benefit is not always to be relied on. This may be accomplished either by simple division of the cicatrix and subcutaneous bands, and the employment of careful and continuous extension afterwards; or by the additional precaution of transplanting a healthy portion of skin from the neighbourhood to occupy the gap; in the latter case all the diseased tissue should, as far as possible, be dissected out, that the borrowed portion may be attached to healthy skin.

SECTION III.

SPECIFIC DISEASES.

SCROFULA.

Scrofula affects both external and internal organs, attacks all classes and ages; and under various phases, prostrates, maims, and destroys vast numbers of our population. The pathological condition which characterises this comprehensive and fatal disease is, the presence of *Tubercle*, which is a deposit of gray or yellow matter, in various forms and in varying quantities, in the different tissues of the body.

The scrofulous or strumous diathesis is usually characterised by fair complexion, light hair, blue, watery eyes, with large pupils, white skin with a bright colour, often apparently denoting florid health. The nervous system excitable. The vessels bleed readily, as of the nose, lungs, &c.; the mucous membranes are irritable; the temper is quick, and the passions are warm; the intellect sometimes precociously keen, at others dull and obtuse. In scrofulous persons of dark complexion, the disease is generally more aggravated and iutractable; in such also the intellect is of lower quality, as in some parts of France and Switzerland. This diathesis is hereditary; it is also asserted, but not satisfactorily proved, that it may be generated by favouring circumstances. Domestic animals have not immunity from the disease.

Tubercle presents itself most abundantly in the form of an opaque, yellowish, cheesy substance, in varying quantities; sometimes as small pearly, granular bodies, scattered through different organs, especially the lungs, and coexisting with the other form. Microscopically, tubercle consists of "fibriniform granules, molecular oil, and aborted cyto-blasts, mixed sometimes with granules of phosphate and carbonate of lime." The softening, whether by chemical changes or otherwise, of tubercle, and the consequent irritation and ulceration of surrounding textures, would seem to explain the phenomena which accompany scrofulous ulceration of an organ such as the lung. Thus tubercle or scrofulous deposit is not the product of inflammation, but is commonly, sooner or later, the source or instigator of inflammation in the locality it may chance to occupy, whether that be lung, liver, lymphatic ganglia, mucous or serous membranes, nerve tissue, muscle, periosteum, or even bone.

Early life is the period in which the phenomena of scrofula are most actively developed: in childhood many organs are simultaneously affected; as the adult period approaches, the softening of tubercular deposit in the lungs is most frequent. But this activity may be deferred till later in life, though the origination of external scrofula after puberty is of rare occurrence. This diathesis would seem, from statistics, to be more common in females than in males.

Besides the general influence of this diathesis in modifying many surgical diseases and influencing the sequences of injuries, the surgeon has to treat scrofulous affections of the external ganglia, especially in the neck, and their sequences; some forms of skin disease; eye diseases, affecting the conjunctiva in particular; ulcers of the same type, sometimes obstinate and destructive, as lupus; chronic abscesses; hypertrophy of the tonsils, and aphtha of the mouth and tongue; ozœna, with necrosis of the bones of the nose; diseases of the genital and urinary organs, such as leucorrhœa, and affecting the testicle and mamma;

and diseases of the bones and joints. These will be noticed in their several proper places as associated with the organs and tissues which are their seat. Some few remarks on the development and general treatment of scrofula will conclude the present brief survey of this widely-spread disease.

Scrofula would seem to be hereditary on both sides, but affecting often only one or two in a family. Those who suffer from early external development of the disease often escape fatal lung disease. Bad air, unwholesome and insufficient food, probably only stimulate its development in the worst form. Any debilitating cause may operate in the same way, as dissipation, excessive study, syphilis, and the eruptive diseases.

The general treatment must be chiefly hygienic, as pure air, especially sea air and bathing, good clothing, nutritious food, exercise. The most valuable medicines are iron, iodine, cod-liver oil. In deciding upon operations for the removal of scrofulous disease, as of joints, &c., the surgeon should always bear in mind that its active development in other and more vital organs is a not improbable alternative, especially where a long-continued discharge has been thus suddenly arrested.

THE VENEREAL DISEASE.

Syphilis assumes numerous phases, and is attended with various consequences, often entailing life-long misery on the first recipient, and descending, as an inheritance, to the offspring. The primary forms of this disease, including gonorrhœa, as at least an allied affection, are a purulent discharge from the genital organs, or a lesion of surface in some part of the same, constituting a sore or ulcer. The secondary forms of the disease affect chiefly the cutaneous surface, the mucous membranes, and the bones.

Gonorrhœa is a purulent discharge from the urethra in the male, or from the vagina in the female. Such discharge is the product of acute inflammation, consequent on exposure to the contagious influence of a like discharge in an individual of the other sex; yet a similar purulent discharge may be the consequence of acute inflammation resulting from other causes, such as local irritation, cold, &c. The treatment in each is the same. Some individuals are more obnoxious to gonorrhœa than others, and the first attack is generally the severest. Its appearance is usually between the third and seventh day after subjection to the infection. First symptoms, itching, irritation, and scalding in making water, soon followed by discharge. The lips of the urethral orifice become inflamed, and the passage is narrowed from swelling and thickening of the mucous membrane and corpus spongiosum, blood being mixed with the discharge. There is chordee, or painful priapism; and the bladder becomes sympathetically irritable. In the severe form, the yellow discharge becomes greenish. The prepuce and glans often partake of the inflammation, and are infected with a discharge (external gonorrhœa); superficial sores may succeed, and phimosis, from swelling of the prepuce, may occur, or be converted into paraphimosis by imprudent retraction of the prepuce. Sympathetic irritation produces enlargement of the inguinal glands, which may terminate in suppurating bubo, or inflammation may be propagated along the vas deferens to the testicle, affecting especially the epididymis; then the urethral discharge generally ceases suddenly.

The early *treatment* of gonorrhœa should not be specific: enjoin abstinence; give a saline purge; mucilaginous and alkaline drinks, with sedatives if necessary. Afterwards give copaiba or cubebs, or both combined, if necessary. At a later period, alum in ten-grain doses, in infusion of roses, or an injection of sulphate of zinc, or of nitrate of silver, varying from one to three or four grains to the ounce, according to circumstances. External gonorrhœa must be treated by cleanliness and some astringent wash: such wash must be thrown up under the prepuce in phimosis, and emollient applications applied externally; it rarely needs division unless there be a sore or wart underneath. But paraphimosis must be overcome by pressing back the glans whilst the prepuce is drawn forwards, using ice, or puncturing the swollen glans if required.

If the prepuce require division, it is better to incise below, by the side of the frænum, or, if there be a redundance of skin, circumcise and then slit up the inner skin. Remove warts with scissors or caustic.

As sequences of gonorrhœa in the male, there may be ulceration of the urethra, followed by abscess in the perinæum, to be treated by early incision. Inflammation of the prostate, requiring leeches and other antiphlogistic treatment. Rheumatic affections, for which the iodide of potassium is a suitable remedy. Ophthalmia, a destructive purulent affection of the conjunctiva, communicated by actual contact of pus conveyed by the hand to the eye. (See "Diseases of the Eye.") Gleet is often very troublesome. Treat by injections, or by the introduction of a bougie smeared with copaiba. Stricture, as a sequence, is caused by narrowing of the canal from deposit of plastic lymph in the submucous areolar tissue. (See "Diseases of Urethra.")

Gonorrhœa in the female extends to the vulva and vagina, the symptoms being similar to those in the male. The treatment is chiefly local, by astringent injections.

Chancre.—An ulcer or sore on the genital organs, propagated by contamination, is termed a chancre. The character of such ulcer is certainly modified, at least in a measure, by the susceptibility of the recipient. Some of these sores are mere open ulcers without special characteristics, and are then of a comparatively innocuous character; others are deep and have a hard circumference and base; this condition betokens a virulent character, one in which the constitutional contamination is reflected. Whether this distinction is to be strictly accepted or not, there is no doubt that the hard chancre is the most intractable, and most usually entails secondary consequences.

If the poison of chancre be applied directly to an abraded surface an ulcer is formed; otherwise a pustule succeeds an itching pimple, and speedily ulcerates. Ten days or a fortnight generally elapse, after subjection to the infection, before the pimple appears. The ulcer deepens and becomes harder round the base. The form is usually circular, but varies; sometimes different ulcers coalesce. If a phagedænic character is speedily assumed, it is usually indicative of feeble power, and the virulent property of the sore is probably modified or lost.

Treatment.—During the first few days the surface of the sore may be destroyed with lunar caustic or nitric acid, or both combined. This may extinguish the virulent character, and secure immunity from constitutional contamination. If too late for this, give mercury, or rub it in. Blue pill night and morning, or once a day, according to circumstances, till the mouth is touched. In strumous or feeble patients, iodide of potassium or nitric acid and bark are preferable. Keep up the action of the mercury gently; apply black-wash, and add opium if there be much pain. If the sore become phagedænic, destroy the surface with strong nitric acid; then soothe, and support the system, avoiding mercury. Chancre may destroy the meatus and be followed by constriction of the urethral orifice; or it may involve the prepuce, frænum, &c. Bubo, as a sequence of hard chancre, results from absorption of virus, and usually attacks only one gland; this is more sluggish at first than sympathetic bubo, but afterwards quickly opens out into a hard irregular ulcer, also virulent in its secretion. Bubo should be opened by a vertical incision. Spreading ulcer of the groin requires specific constitutional treatment, and to be dressed with mercurial wash or ointment. When these large ulcers become phagedænic and spread, nitric acid should be freely applied; subsequently stale-beer-grounds poultice; and bark, ammonia, wine, and good nutriment must be given.

SECONDARY SYMPTOMS exhibit themselves in the mucous membrane of the throat, tonsils, mouth, and nose, the skin, the iris, the periosteum, and, apparently, the bones. Some weeks at least elapse, often months. The throat is generally first affected; erythema, followed by ulceration, sometimes deep and destructive. Eruptions on the skin; as papular, lichen, psoriasis or lepra, all of a coppery hue. Pustules, rising and drying in the form of a cone, constituting tubercular eruption. Ulcers of the tongue or fissures, often hard and malignant-looking. Iritis, running a rapid course, and terminating by deposit of lymph which becomes organized (see Eye). Node, which is inflammation of the periosteum, with thickening or suppuration. Pains in the limbs, ostitis followed by exfoliation, are also enumerated among the secondary effects of syphilitic poison; these, if not usually the effects of mercurial poison, are certainly aggravated by the long-continued influence of this mineral on the system, especially in strumous patients.

Treatment.—In secondary affections the treatment must vary much, according to the intensity of the affection and the power of the patient. Mercury should be given sparingly in most cases. In sore-throat, tonics, with small doses of Plummer's pill at night, and iodide of potassium twice a day; astringent gargles. In phagedænic ulcer of the throat, support, and apply linimentum æruginis, or strong nitric acid; detergent gargles; mercurial fumigation is occasionally useful. In ulceration of the larynx, tracheotomy may be needed. In eruptions, give bark with iodide of potassium or small doses of the bichloride of mercury. Treat ulcer of the tongue in the same way. Iritis requires the same treatment as when not specific; mercury is essential in both. Nitro-muriatic acid, or the tincture of the sesquichloride of iron, are valuable tonics. Sarsaparilla may be given in all; but its value is probably overestimated.

TUMOURS.

The word tumour is very comprehensive in its application, being employed to designate various forms of morbid increase in the bulk of a part, whether from hypertrophic growth, from diseased deposit, from the accumulation of natural secretion, or from addition of natural texture. Some tumours may be purely local in their origin, others are constitutional and evince a tendency to reproduction, if removed. Tumours affect various tissues, as skin, areolar tissue, mucous membrane, bone, &c. They differ in their physical characteristics and anatomical structure, as well as in their activity in growth; their diagnosis is, therefore, often obscure, and demands careful inquiry involving many questions as to history, temperament, and other collateral circumstances.

Tumours may be classed according to the tissues which they severally affect. The details of this classification will be noticed under the diseases of different tissues. Or they may be classified under the two heads of tumours of which the structure is natural, though in excess, and those which consist of new structures. Preference is here given to that classification which assigns to tumours a local or a constitutional origin; in the former category are included encysted and hypertrophic growths, in the latter the various forms of cancer.

ENCYSTED TUMOURS have their origin in an accumulation, by abnormal secretion or obstructed evacuation, of the natural fluid or solid products of the affected cavity or duct; and are met with in various tissues and organs. The *skin*, especially the scalp, is the seat of these tumours, their origin being in an obstructed sebaceous follicle. Their contents vary in consistence, being thin or unctuous fluid, cheesy or suety. They sometimes attain a large size, and are removable by excision.

The submaxillary *salivary duct* is the seat of abnormal distension from obstruction resulting from inflammation or the presence of concretion; this is termed ranula: to be treated by incision.

Synovial bursæ are similarly distended, as that over the patella, on the semi-membranous muscle, on the nates, or in the palm of the hand or on the wrist. The usual cause is abnormal pressure or friction. These sometimes suppurate, or their contents become fibroid from inflammatory deposit. When uninflamed, if these tumours be opened, it should be done cautiously and subcutaneously (with certain exceptions to be noticed with the affected tissues), or dangerous inflammation may ensue.

The *thyroid gland* may be the seat of these cysts, single or multilocular. *Hydrocele* is such an accumulation in the tunica vaginalis. These cysts occur beneath the tarsi or in the meibomian follicles of the *eyelids;* also beneath the mucous membrane of the *lips* and *cheeks*. Cysts, independently of a natural secreting surface, are found in the *testicle*, *mamma*, *kidney*, &c. Hydatid cysts occur most frequently in the liver.

HYPERTROPHIC TUMOURS affect the *skin* in the form of pendulous, pedunculated growths; similar to polypus from a mucous surface: they should be removed by excision or ligature.

Fatty tumours consist of a circumscribed hypertrophic growth of fat; they occur at various parts of the trunk and extremities, and should be excised.

Fibrous tumours, consisting of normal, fibrous tissue, uniform or lobulated, occur in the breast, testicle, uterus, ovary, sometimes attaining a very large size, and containing calcareous matter, or existing in combination with cysts (fibro-cystic). These may undergo softening.

Cartilaginous tumours grow from the surface or inside of bones, varying in consistence at parts, or partially converted into bone. This conversion is genuinely ossific, as in ossification of the normal cartilage of ribs, larynx, &c.

Bony growth occurs in the form of exostosis or general hypertrophy; this is true bone. Sometimes such bony growth is produced on the surface of malignant tumours.

Vascular tumours. (See "Diseases of the Vascular System.")

CANCER.—Tumours which have a constitutional origin, and are not due to locally augmented action alone, are prone to return, if removed, and are for the most part designated *malignant*, from their fatal influence on health and life. Yet all constitutional tumours are not malignant, nor are all local tumours without danger. Thus, scrofulous tumours do not necessarily threaten life; whereas large fibrous or cystic tumours connected with internal organs, as those of the uterus and hydatid cysts, are often fatal even from mechanical causes, and consequent interference with function.

Cancer differs from all other growths in many features besides its microscopic characters: it is an eliminative action established in some selected locality, and is exhaustive alike of the elements of life and of nervous energy. The product which forms the tumour is no conversion of texture, no hypertrophic growth, nor accumulation of natural secretion, but essentially new. It is uncontrollable by any known agent, and is often hereditary.

Cancer presents itself in three different forms, viz., encephaloid, colloid, and scirrhus.

Encephaloid is characterised by its brain-like appearance and texture: it is the most rapid in its development; and exhibits, under the microscope, cell-growth in various stages and forms, the discharge from it containing the same elements. Occasionally, on section, black pigment is seen deposited in more or less abundance; this is the melanotic form of the disease. Blood also may be extravasated into it; and when a tendency to bleed in the protruding growth, after ulceration of the surface, exhibits itself, the term fungus hæmatodes is applied to this condition. The chemical constituents are fat and albumen, but the latter in greater abundance.

Scirrhus is the same material deposited in the interstices of fibrous bands; being sometimes quite cartilaginous in hardness, but less vascular and more indolent than the encephaloid. To the touch a scirrhous tumour is generally dense, hard, inelastic, irregular, and heavy.

Colloid is gelatinous in appearance and texture: the deposit, which is constituted of the same elements as in the other forms, is deposited in cells. This form presents itself not infrequently in combination with the encephaloid, sometimes with the scirrhus.

What peculiarity in the constitution may determine the form in which cancer is developed is unexplained. The encephaloid form of the disease is not only the most rapid in its development, but also the most hopeless in the surgeon's hands. Scirrhus, being slower in growth and not ulcerating so readily, extends rather by contamination of neighbouring lymphatic glands.

The appearance of these tumours is often ascribed to some source of local irritation or injury: such exciting cause may, no doubt, determine the development of the disease in organs or parts of naturally high organization, where the predisposition to cancer exists. Vascular organs, the active functions of which have ceased, are specially obnoxious to cancer. The statistics of an eminent and careful observer,* give the following order, in frequency, of the various organs which are attacked by cancer :—Uterus, female breast, stomach, rectum, lymph-glands, liver, peritoneum, bones, skin, brain, globe of eye, testicle, ovary, kidney, tongue, œsophagus, salivary glands. Colloid is more frequent in the stomach, rectum, and peritoneum ; scirrhus in the female mamma, also in the stomach and intestines : encephaloid attacks all organs, but is found, to the exclusion of other forms, in the liver, kidney, lung, testicle, eye, and lymph-glands ; and is the only form prone to secondary development, by actual contact or conveyance in the circulation.

When cancer ulcerates, the discharge is generally abundant and fetid. The surface may fungate or become excavated; the pain is severe, and exhaustion is proportioned to the discharge and suffering.

The question of operation is one surrounded with difficulties. Removal of cancerous growth rarely effects more than affording relief for a time, and deferring a fatal issue. It may, on the contrary, hasten it, by transferring the morbid action to some more vital part. Where scirrhus is indolent, it is probably wiser to leave it alone. Such indolence or arrested growth in an external tumour is sometimes coincident with its internal development. If removal be determined on, the knife is the best instrument; the entire diseased growth should be abstracted, and the wound be closed, if practicable.

Epithelial cancer, the consequence of local irritation, is much more amenable to treatment by operation.

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* Rokitansky.

SECTION IV.

ABNORMITIES, DISEASES, AND INJURIES OF TISSUES.

Skin.—Congenital deficiency of the skin is rare, except in connection with median defects from arrested development, such as hare-lip. Excessive growth occurs in subcutaneous tumours, or in pendulous folds after distension. Abnormal thickness is usually the consequence of congestion and inflammation: and the skin is abnormally thin when excessively distended, as in dropsy. Discoloration, either partial or universal, may result from disease, or the action of medicine, or external influences. Such are the blue appearance in cyanosis, from the circulation of ill-oxygenated blood; the pallor of chlorosis; the bronze hue in supra-renal disease; and the leaden hue from nitrate of silver. Claret and bronze spots or patches are congenital. Freckles or tanning from the sun's influence are due to deposit of pigment in the epidermis. Petechiæ, in typhus or scurvy, are circumscribed spots of extravasated blood in the skin.

Inflammation of the skin and its sequences have been already noticed (see Erysipelas, Phlegmon, &c.). Cancer, as a primary disease, attacks the skin in its scirrhus and medullary forms. Chimney-sweeper's cancer is the latter; it begins on the scrotum as a warty excrescence, which subsequently ulcerates and fungates: the testicle may become involved. This disease should be early extirpated with the knife. Parasitical insects and vegetables infect the skin, as in scabies and porrigo favosa.

The loss of skin by injury or sloughing is serious in proportion to its extent. Constitutional disturbance is severe where the loss is large, and even fatal collapse, or death after reaction may occur. Therefore, in operations and after injuries the skin should be dealt with as an important and delicate organ, and not as a mere covering to the deeper textures. Redundancies, such as pedunculated tumours, condylomata, and warty growths, may be safely removed. The knife is usually the best instrument, or scissors may be more convenient, or it may be safer and more expedient to employ the ligature or caustic. Common wart, which is hypertrophy of papillæ beneath a thick layer of cuticle, is best treated with nitric acid and nitrate of silver, or with caustic potash.

The texture of a cicatrix is dense, inelastic, and, where there has been a large breach of surface, white, hard, and stretched over the deeper textures. This is not skin, but a substitute for it, as it is without papillæ, sebaceous or sudoriparous glands, or hair-follicles. Its physical defects are, in great measure, due to the absence of normal subcutaneous areolar tissue. The contraction after extensive loss, as from burn, often seriously impairs motion, and requires operation for its relief. Simple section of the firm fibroid bands with the cicatrix may liberate the bound parts; but for permanent relief, the most efficient method is to transplant a portion of healthy integument into the gap from a neighbouring part which can best spare it: for this purpose the cicatrix should be first excised.

Cuticle may be thickened into laminated callosities, which are the consequence of pressure or friction, and sometimes press painfully on the cutis. A corn is a conical projection of cuticle pressing vertically on the cutis. Soften this by poulticing, and then carefully excise it, subsequently protecting the part from pressure. Bunion, which, when inflamed, is sometimes confounded with corn, is a bursa, usually over the deformed articulation of the great toe, between the metatarsus and first phalanx. It should be protected from pressure, and, if suppurating, cautiously opened. Horny growths are essentially cuticular or follicular in their origin.

The *nails* have their growth curtailed or arrested in paralysed limbs, and during union of fracture. They often become excessively thickened or painfully deformed from pressure and neglect. The nails have a peculiarly curved form in consumptive patients. The loss of a nail in whitlow or from wound is usually, though sometimes imperfectly, repaired. In-growing nail is the consequence of pressure, the inner border of the nail being usually driven into the skin. It should be softened and carefully cut away. Inflammation and ulceration may extend round to the root of the nail, and necessitate its entire removal. Sometimes the application of nitric acid will loosen it, or it may be desirable to excise it. A fetid ulcer occasionally attacks the roots of the nails, for which nitric acid, in full strength, is the best application.

The *hair* may be congenitally defective in part or entirely. Its growth is sometimes excessive; and, in some instances, precocious on the face and pubes. Sudden loss of colour has occurred from the influence of depressing passions. Hair is occasionally found in cysts. In plica polonica the capillary canal is distended with moisture, which exudes and mats the hair together. In porrigo decalvans the scalp is white, shining, and bald in patches. Free rubbing with strong acetic acid is the best remedy. In tinea, which spreads eccentrically, the same remedy may be used alternately with an ointment of bichloride of mercury, five grains to the ounce.

The SEROUS and SYNOVIAL MEMBRANES are not infrequently the seat of injury or operation, and may be placed, surgically, in the same category. Serous membranes, as the pleura and pericardium, sometimes communicate. Persistence of communication between the peritoneum and tunica vaginalis determines the congenital form of hernia, in which the latter forms the sac. Bursæ may in like manner communicate with joints. Excessive development is exemplified in hydrocephalus and spina bifida. Tapping, to withdraw the accumulated secretion, followed by pressure, may afford relief. Obliteration, or degeneration into areolar tissue, may result from inflammation, as in the pleura, pericardium and peritoneum. Such is often the consequence of operation for the radical cure of hydrocele. Bursæ are developed over club-foot, &c.; and a similar development takes place in new joints after unreduced dislocation. General distension is the consequence of accumulated secretion, as in ascites, hydrocele, hydrops articuli: all may require tapping; and distended joints have been treated, like hydrocele, by injection of iodine.

Congestion of serous membrane may be caused by disease or mechanical obstruction, as in strangulated hernia. In operating, the appearance of the intestine is a guide in the prognosis. The consequences of long-continued congestion are increased secretion, opacity, thickening, or transudation of blood.

Inflammation may be primary or consecutive. It may result from cold or injury, as in joints. Inflamed serous or synovial membranes are injected, and subsequently may become opaque or thickened, or pour out an increased secretion, or plastic lymph or pus. When the exudation is coagulable, adhesions follow; or pus may require evacuation, as from the peritoneum, pleura, or joints. Hæmorrhagic effusion into the large cavities is often fatal. Gangrene occurs, as in hernia, from continued obstruction, or excessive inflammation. The subserous areolar tissue is often seriously involved in these changes.

The *treatment* of the above conditions must be conducted in accordance with the general principles already laid down.

Serous membranes are the seat of tubercle, and of the medullary form of cancer. Gas may be found in serous membranes, the reults of decomposition, or by escape, as from the lung into the pleura (where paracentesis may be required), or from perforated intestine into the peritoneum. Accumulation of pus in these membranes may also require evacuation. Loose fibroid bodies are sometimes met with in serous membranes, but more often in synovial sacs; these are probably deposits in the areolar tissue, and subsequently become free by the separation of their pedicle: they may be coagulated secretion. In the knee they sometimes require removal.

In *wounds* of joints, endeavour to close the lesion entirely; and treat the consequent inflammation on general principles, not forgetting perfect rest. The risk of opening an already inflamed or diseased serous or synovial membrane is infinitely less than of exposing them in health. (For further details, see "Injuries, &c., of Joints and Regions.")

MUCOUS MEMBRANE.—Congenital deficiency occurs in arrested development, as in open bladder, fissures of the mouth, &c. The cicatrix following loss of mucous membrane differs, like that of skin, from the original texture. Pseudo-mucous membrane is produced in sinuses, and requires destruction by caustic or incision. Inflammation and its consequences have been noticed. Adhesions are rare; but plastic lymph is sometimes deposited on the surface of a mucous membrane. Ulcers are not infrequent, especially at the outlets. Deposit, from inflammation in the submucous areolar tissue, is a frequent source of stricture. Œdema affecting the glottis may be fatal. Mucous membrane may mortify, as in hernia.

Exposed mucous membrane becomes dry and cuticular, as in prolapsed anus or uterus. It is the seat of nævus, as on the lip, tongue, vagina; also of tubercle; and of cancer both fibrous and medullary.

AREOLAR AND ADIPOSE TISSUES.—Areolar tissue forms the bulk of some tumours. It may be hypertrophied or thickened; or atrophied when subjected to pressure. These tissues are often involved in destructive ulceration or sloughing. They sometimes lodge foreign bodies, and are the seat of bloody effusion. Dropsy of the areolar tissue has already been noticed.

When *inflamed*, both areolar and adipose tissue are red from injection. Plastic exudation blocks the areolar spaces; and this may soften down, and suppuration ensue: hence the diffusion of pus under such circumstances, as in phlegmon, wherever this tissue abounds. In adipose tissue the fat may be displaced by plastic exudation. Chronic inflammation in these tissues tends to induration, as around varicose ulcers. This condition may be general, as in a varicose limb; such is elephantiasis. In poisoned blood, pus is sometimes deposited at spots in the areolar tissue; such abscesses should be immediately opened; they heal readily. Gas is found occasionally in the areolar tissue, as in emphysema or from decomposition. It is the seat of cystic and fibrous tumours, also of tubercle and cancer. When lost by sloughing, or otherwise, the reproduced texture wants elasticity. Adipose tissue is scanty where it would interfere with movements; but occasionally it is the seat of excessive deposit, as on the abdomen.

MUSCLES.—Muscular abnormities are frequent; arrested development is rare. Congenital defects in length, development or power, entail deformities, such as club-foot, &c.; these will receive separate attention. The muscles become pale, weak, and flabby, from disease, as in paralysis; this is often accompanied by fatty degeneration. Hypertrophy results from excessive use; in the involuntary muscles this becomes a disease, as in the heart. Muscle may be ruptured from spasm; but this is rare. It has occurred in the heart and in the uterus. Divided muscle is reunited by fibro-cellular tissue.

Muscles become *inflamed*, as from cold or injury; they may be the seat of serous or bloody exudation.

The contraction following such inflammation may require tenotomy. The division of muscular tissue is rarely needed in operations, except amputations. Muscle is occasionally the seat of nævus, also of cancer. Foreign bodies may become encysted in muscles.

Tendons may require division to remedy deformities, or to facilitate the adjustment of fracture, or reduction of dislocation. Sometimes they are accidentally cut or ruptured. If inflamed, as in thecal abscess, they sometimes slough to a considerable distance from the original disease, pus extending along their sheaths. In dividing a tendon, try to preserve its tubular sheath. The fibrous reunion of a divided tendon very closely resembles, on section, the original texture. (For operations, see last Section.)

FIBROUS TISSUES include ligaments, aponeuroses, annular, plantar and palmar fasciæ, the pericardium, dura mater, and theca vertebralis, the periosteum, middle coat of arteries, &c. Suppuration or ulceration may occur as consequences of *inflammation* of fibrous tissue; but more commonly induration or thickening. Contraction of the plantar or palmar fascia results from chronic inflammation. The only efficacious treatment is subcutaneous section of the contracted bands, and subsequent extension: this is often mistaken for contraction of tendon. Sloughing of fibrous tissue may occur as in other tissues; the dura mater commonly sloughs after trephining. Inflamed periosteum often leads to destruction of the subjacent bone; but the loss of the fibrous tissue does not necessarily entail necrosis. Fibrous tissues are readily calcified, as seen in the pericardium, dura mater, and arteries; also in abnormal growths. When cancer attacks the periosteum, it is usually the medullary form, and soon involves the bone. (For ligaments, see "Joints.")

CARTILAGE, though rarely defective, is often found in abnormal growths, generally mixed with fibrous element. Cartilage may be torn or broken, and repaired. *Inflammation* affecting the synovial membrane or the cancellous texture of a bone involves the cartilage, which perishes first on its surface contiguous to the seat of disease. Inflammation of fibro-cartilages, as between the vertebræ, terminates in suppuration, and entails caries of the vertebræ, and even inflammation, from contiguity, of the spinal membranes. Cartilage is subject to ossification, especially as age advances, as in the ribs, larynx, trachea, &c.

BONE consists of an animal base and of earthy matter deposited therein: it is invested by a vascular fibrous membrane, the periosteum; and the cylindrical bones are also lined by another, the medullary membrane.

Partial *deficiency* of bone may result from arrested development, as in the sternum; from arrested ossification, as in congenital rickets; also, in the skull and spine, from hydrocephalus and spina bifida. This condition may be reversed, in premature closure of the fontanelles and sutures. *Hypertrophy* in length or circumference of long bones, and in density or expansion of the diploe of flat bones, results from hyperæmia, perhaps chronic inflammation of a specific type. The varying density of the skull should be remembered in the use of the trephine. *Exostosis* is a bony growth springing from the periosteum or the bone itself; it may be spongy or cancellous, but is usually firm and compact, sometimes of ivory density, or capped with a thick layer of cartilage. There are sometimes many such in one patient; and they occur principally on the ends of long bones, on the ungual phalanx of the great toe, and on the pelvis; they also spring from the interior of the skull. They usually grow spontaneously, but may result from injury. They do not grow indefinitely, but their removal is often required, where practicable, on account of their inconvenience. This is most readily effected in most cases by exposing the tumour, and cutting it through with bone forceps; a small saw may be used if required. Care must be taken not to interfere with joints when these bony growths spring, as is usual, near to them. *Atrophy* is the consequence of arrested development; of carious disease, or similar sources of exhaustion. Length as well as thickness may be diminished; the bones thus become brittle, as in old age from similar attenuation. Pressure produces atrophy by absorption, as in aneurismal and other tumours.

Inflammation of bone may originate in the osseous texture itself, or be propagated from neighbouring textures, especially the periosteum or medullary membrane. It may be either acute or chronic, and may affect either the surface or substance of bone. Deterioration of the vital powers from the poison of syphilis, mercury, gout, or fevers, often constitutes the predisposing cause of ostitis; mechanical injury, or cold, are the usual exciting causes. The symptoms vary according to the acuteness of the attack: the pain is local, deep-seated and aching, sometimes intermittent, and usually worse at night: the same in periostitis. Severe constitutional disturbance ushers in the attack, whence the frequent mistake that necrosis is the sequence of acute rheumatism or fever. The superjacent integuments become swollen, red, and tender. The local *treatment* of this stage is by leeches and warm applications; and free incision if pus be perceptible: the general treatment is by anodynes and attention to the secretions. Acute inflammation of the surface of bone may terminate by exudation which becomes organized without destruction of texture, induration succeeding. When the substance of a bone is involved, pus is formed in the cancellous structure, and permeates the fibrous texture: necrosis is then inevitable. The sympathetic fever accompanying this condition is severe; and pyæmia, from absorption of the pent-up pus by the veins, is a not infrequent sequel. Such inflammation and its consequences rarely extends from the shaft to the epiphyses of long bones. Chronic inflammation in periosteum or bone may terminate in node, or in tedious suppuration, entailing exfoliation. In the early stage, blister or apply iodine, giving the iodide of potassium internally. In abscess, from limited suppuration, as in the tibia, the trephine should be applied: the symptoms of this condition are often obscure; the pain is continuous and deep-seated. Paronychia may commence in the periosteum, or attack the bone itself, the inflammation of the digital phalanx being acute. Incise freely, deeply, and early: the bone often perishes.

Caries, or ulceration of bone, rarely affects the compact fibrous texture of the shafts, but usually attacks the cancellous structure of the extremities of the long bones, or the irregular bones, as the tarsus or vertebræ. It is often a sequence of syphilis, but occurs most commonly in scrofulous subjects. Caries may arise spontaneously, or as the result of injury, or by propagation from contiguous textures, as in joint-disease. When cancellous structure is attacked, it assumes a red, softened, infiltrated appearance, and yields under the finger. The surrounding parts, which are also swollen and infiltrated, suppurate and ulcerate. Sometimes the shell of carious bone expands and forms a large cavity (spina ventosa), containing loose portions of spongy texture and pus. Such caries and abscess may heal readily after opening, or be very tedious; the former when the disease is the consequence of external injury; the latter when spontaneous, and occurring in a deteriorated or scrofulous constitution. The attendant pain at an early period is often severe, and of a gnawing character; subsequently it is much mitigated. The discharge varies in quantity and quality, and escapes by a small external opening, either callous or surrounded by soft, infiltrated granulations. New bone is thrown out at a later period. Sometimes a sequestrum co-exists with caries.

Treatment.—Counter-irritation at an early period may limit the diseased action. Excision by gouging often creates new mischief by violence to surrounding parts; but a free external incision is often serviceable, as in the treatment of a sinus. Trust most to rest, soothing applications, free vent for the discharge, and constitutional support. Reproduction of bone after caries is limited. In the tarsus, the continuity of the synovial membrane favours the extension of the disease.

Necrosis, or mortification of bone, is consequent on acute inflammation resulting usually from violence or cold. The constitutional tendencies are much the same as in caries. Inflammation may attack the bone primarily, or it may be secondary on inflammation of the periosteum or medullary membrane. Necrosis commonly affects the parts least liable to caries, viz., the compact texture of the shafts of bones, and may affect only an external plate; or the entire structure of a cylindrical bone may perish. Separation of periosteum is not necessarily followed by death of bone. The most superficial bones, as the tibia, are most liable to necrosis. In internal necrosis the dead fragment is called "sequestrum;" and its presence is a permanent source of irritation, whereby new bone is thrown out in the shaft and around its exterior, and pus finds its way through openings called cloacæ. The sequestrum may escape spontaneously if small; if large and loose, the existing openings in the new bone must be sufficiently enlarged with a trephine, forceps, saw, or chisel, to remove it entire or in fragments. When the whole shaft perishes, there may be reproduction, or a new case formed around the old bone: partial necrosis at various points is more frequent. The discharge is often so copious as to exhaust the patient, and thus necessitate amputation.

The *process of separation* is analogous to that of a mortified soft part, *i. e.* a softening down or solution of the healthy texture adjoining the dead. This is accompanied by abundant secretion of pus, containing the earthy constituents of bone in solution and minute sub-division; hence the inequalities and perforations of a sequestrum.

Reparation keeps pace with separation. Where the necrosis is superficial, new bone is deposited beneath the periosteum; as destruction extends deeper, a similar process takes place in the substance and medullary canal of the bone, and thus a sequestrum is enclosed; and suppuration and exudation do not cease till it is removed. Muscles gradually loose their attachments, and become connected to the new bone without. After removal of the sequestrum, new bone occupies its position; and, after a time, this solid cylinder becomes cellular from enlargement of the Haversian canals. When the sequestrum is thrown off, and reparation perfected, the remnant of the original bone is enclosed between an external layer of new bone and an internal deposit which occupies the medullary canal. When the entire thickness of a cylindrical bone perishes, reparation takes place in the same way, viz., by deposit within and without the dead cylinder, and the subsequent occupation of the site of the sequestrum by new bone.

The process in flat bones is similar, but the deficiency is rarely closed by bone; fibrous tissue takes its place. Not only the periosteum and living bone, but even the surrounding soft parts, aid in the reparative effort following necrosis. Death of the temporal bone may involve, by contiguity, the membranes of the brain, and the brain itself, in inflammation.

Osteoporosis is an expansion of the cells and Haversian canals of otherwise healthy bone, and may affect parts of a bone or a whole bone. It is most common in the bones of the skull, and is usually attended by attenuation of the compact tissue.

Rickets is a disease of childhood, usually commencing about the third year, and first in the lower extremities. It is accompanied by low vital power, a tumid abdomen, sickly countenance, and spare muscular development. Though the glands are often enlarged, it seems to be rarely accompanied by tubercle. The bones appear swollen, especially at their articular ends and wherever cancellated structure abounds. This state depends on one of two conditions; either the walls and cells are thinned, expanded, and vascular, or the earthy constituents are deficient; in the former state the bones are fragile, in the latter they yield to pressure.

The general treatment consists in invigorating the system by pure air, good diet, bathing, friction, and the exhibition of steel and cod-liver oil. Rickety children should not be encouraged to walk early, but artificial support should be dispensed with unless essential: rickety limbs grow straighter as strength increases. Lateral curvature of the spine must be treated by rest in the recumbent or prone posture. Deformity of the chest, carrying the scapula with it, is secondary to lateral curvature of the spine.

Mollities ossium resembles rickets in its mechanical consequences, but differs essentially in other particulars. The bones are thinned and atrophied, and the seat of abundance of fat, and readily yield under pressure or break. This disease occurs in adults and towards old age; especially in females; and more in the trunk than the extremities, the chest and pelvis becoming distorted and flattened. It is a painful and rare disease, and quite intractable; and is not infrequently associated with cancer in other organs.

Nævus, or an analogous condition in which the enlarged capillary vessels distend the bony canals and cells, is sometimes met with; blood is extravasated and the bone absorbed.

Cysts are most common in the lower jaw: they are developed in the interior of the bone, distending especially its inner wall, which is sufficiently thinned to yield, with a crackling sensation, under the finger. They contain synovial, gelatinous, or cheesy matter. Being painful from distension, they are sometimes difficult to distinguish from cancerous swellings. They should be laid freely open from within, and suppuration should be encouraged.

Fibroid tumours grow in the cancellous structure of bone.

Enchondroma, or cartilaginous growth, springs from the surface, chiefly of the fingers, toes, ribs, or sternum; these tumours sometimes ossify.

Tubercle, as already remarked, leads to caries, abscess, and loss of structure in bone; and is thus the source of great and freqnent deformity.

Cancer may attack either the interior or surface of a bone, distending and thinning its walls, or forming a tumour which springs from and adheres to its exterior. Its treatment must be conducted on the general principles already noticed. (See Cancer.) The Haversian canals, and the tissues lining the cells and medullary cavity, are the seat of this internal deposit.

Foreign bodies may be permanently lodged in and surrounded by indurated bone; but they more commonly excite inflammation, terminating in necrosis. The same result may be the consequence of laceration of the periosteum by violence.

FRACTURE.

Fracture, or the breaking of a bone, may occur at all ages, though the old are more obnoxious to this injury than the young. Nearly all the bones are liable to fracture, but some much more so than others: those which are employed as levers are, for obvious reasons, most frequently broken. Fracture may occur in three ways: as the consequence of direct violence, of indirect violence, or of muscular action; thus, a blow upon the humerus may produce fracture; the radius may be broken by a fall upon the hand; fracture of the patella is caused chiefly by muscular action. The direction of a fracture may be either transverse, oblique, or longitudinal; and the amount and character of displacement are thereby in great measure determined. Fractures may be simple, *i.e.*, without external lesion; or compound, *i. e.*, with a wound communicating with the fracture: such lesion may be the consequence of violence from without, or from penetration of the bone from within. Further, fractures may be single; multiplied or comminuted, *i.e.*, broken into three or more fragments; or they may be complicated with vascular lesion, or accompanied by dislocation; and, lastly, they may extend into, and thus involve, joints.

The *symptoms* more or less constantly present are distortion, abnormal mobility, crepitus, loss of power, pain, swelling and spasm. These vary much according to circumstances.

In the *treatment* of fracture the two desiderata to be kept in view are rest and position. These objects can be jointly attained in two ways, by forced extension, and by relaxation of the muscles. Advantages attach to each plan, as will be illustrated in detail. Division of tendons, to negative muscular spasm, may occasionally be serviceable, but should not be lightly resorted to.

In *simple* fracture, the limb should be placed in an easy position, with or without apparatus, as necessity may dictate, until the subsidence of the early swelling: under any circumstances compression must be scrupulously avoided, by either bandage or apparatus, in this early stage. The period for keeping fractured bone at rest varies according to the weight it has to support, the age, health of the patient, &c. A fracture should be frequently inspected; and that apparatus is best which, fulfilling other requisites, most readily facilitates such inspection.

In double or *comminuted* fracture, the same treatment is required, but more care and longer time are demanded: the possibility of exfoliation of isolated fragments, in such cases, must not be lost sight of.

In *compound* fracture, the increased risk depends very much on the amount of contusion of soft parts. Thus, a bone forcing its way through the skin generally involves more of such injury than the penetration of a foreign body from without. Such external wound may heal readily, and this result should be encouraged; or suppuration, local or diffused, or even sloughing, may ensue. Close the wound, then, if possible; if not, soothe and facilitate the escape of pus and blood. The question of amputation in compound fracture includes many considerations besides the character and extent of the injury, such as the age, health, temperament and habits of the patient. The same amount of injury may thus demand amputation in one instance, whereas a limb may be saved in another. Where doubt exists, the patient should have the benefit of that doubt, as the alternative of secondary amputation is still offered; and such secondary operations are, on the whole, more generally successful than primary, if discretion be exercised in selecting a favorable opportunity. But many cases admit of no doubt; and amputation should not be deferred, unless shock or loss of blood demand a temporary delay. The most favorable time for secondary amputation is indicated by the general condition of the patient, as regards pulse, tongue, &c.; and a local condition indicating a reparative effort, though abortive. Where a joint is involved, or an artery laccrated, amputation is more generally rendered imperative. If a protruding bone cannot be readily reduced, it is best to saw off its extremity. In cases of wounded artery complicating fracture of the leg, the femoral artery has been tied successfully. The possibility of severe and even fatal secondary arterial hæmorrhage, from extension of ulceration in compound fracture, should not be lost sight of: in such cases immediate amputation is often the only chance of saving life.

Reparation.—The first effect of fracture is extravasation of blood into all the surrounding tissues, proportioned usually to the degree of laceration of the soft parts: thus, the areolar tissue, sheaths of muscles, and fasciæ, become more or less distended. Serous infiltration succeeds; and, as this subsides, the broken ends of the bone are left surrounded by a bed of inflammatory exudation, more distinct in deep than in superficial bones. This deposit is derived from the medullary membrane, as well as the periosteum and surrounding textures. If there be an interval between the broken ends, each has its own capsule. This plastic exudation gradually becomes cartilaginous as the surrounding absorption proceeds, and the medullary cavity is thus occupied and blocked. The cartilage becomes, in turn, the seat of ossific deposit, and is termed *callus*. The surface of the fractured bone and the surrounding textures then take a more active part in the deposit of new bone, until a compact mass unites them, replacing the previous spongy deposit. At a later period, long after consolidation, the superabundant deposit is absorbed; and still later—after twelve months or longer—the internal deposit is removed, and the medullary cavity and cancelli are restored.

Union of fracture is often retarded and even prevented by constitutional or local causes, or by neglect and careless or ignorant treatment. The wide separation of two broken ends, or the interposition of a loose fragment of bone or other tissue may thus act; but in some cases no cause can be assigned. The local treatment of such cases is by absolute and prolonged rest; or by rubbing the broken ends together, or sawing off the ends, or introducing a seton. Absolute rest, with a seton, constitutes the most desirable local treatment, combined with attention to the health and habits of the patient, giving the wonted stimulus, &c. Where a syphilitic taint is suspected, mercury may be given. Deformed union rarely admits of being remedied except in young and recently united bones. Young bones will sometimes yield without breaking; this is especially remarkable in the very young skull.

FRACTURES OF PARTICULAR BONES.

OSSA NASI.—Broken by direct violence. Treat by restoring them to their normal position, if displaced, introducing a probe or bougie into the nostril for the purpose. These injuries may be followed by abscess or necrosis.

Superior maxilla.—From direct violence. These fractures usually do well, without interference.

Zygoma.—Very rarely fractured. The movement of the lower jaw is impeded by compression of the temporal muscle. No treatment is required.

Inferior maxilla.—From direct violence, or force applied to another part of the bone. It may be broken in the horizontal or vertical ramus, at the symphisis, angle or processes. Sometimes a double fracture occurs. Some of these fractures are best felt from within, being accompanied by wound of the gums, and sometimes troublesome bleeding. Displacement, from muscular action, is often considerable. Treat by enclosing the jaw in a mould of gutta percha or leather, fixed with a bandage. If requisite, adjoining teeth may be held together with wire: the mouth may be fixed open with a wedge. Forbid mastication.

Skull.—(Mechanism of fracture.) Separation of sutures rare, except accompanied by fracture. The skull may be fractured by violence directly applied to the seat of injury, or to some neighbouring or distant part of the cranium. These fractures may be thus classified:—Simple fissure of one or both tables; simple, compound, or comminuted fracture, with or without depression of bone; fracture through the base of the skull. Fracture of the cranium may be produced by a fall on the head, or by the violent contact of some obtuse or penetrating body. The more extensive fractures are not necessarily the most dangerous; circumscribed depression of bone is almost invariably accompanied by compression of the brain; but not so, when the extent and nature of the displacement admits of the brain yielding in another direction. Extravasation of blood is a common and serious concomitant of fracture, especially of the base. Fracture through the petrous bone is frequently accompanied by bleeding and serous exudation from the ear, indicating intrusion on the tympanum and laceration of its membrane; but bleeding from the auditory canal is not necessarily indicative of fracture of the base of the skull. The usual course of such fractures, which are produced by the concentration of momentum around the occipital foramen, is through the basilar process, and across one or both petrous bones. These and other fractures may involve the venous sinuses or great meningeal artery: when exposed, bleeding from these vessels may be readily controlled; but of course due regard should, if possible, be had to their position in trephining. The outer wall of the frontal sinus may be fractured and driven in, without the inner table suffering. Reparation of fracture either of the vault or base of the skull may be effected by bony union; but when a chasm is left by exfoliation of an isolated fragment or after the use of the trephine, it is occupied by fibroid tissue, unless the space is very limited.

Contusion, without fracture, may be followed by circumscribed extravasation of blood beneath the periosteum, simulating fracture with depression. A probable consequence of this injury is suppuration and exfoliation of the external table; or, if the bone become inflamed, both tables may perish, and head symptoms may result from pus being poured out between the bone and dura mater. In this last event the trephine must be used.

(For head symptoms and their treatment, see "Injuries of the Nervous system.")

Spine.—The multiplied articulations, elasticity, and curves of the spine protect it from frequent injury;

but it may be broken at any point. Fracture of the spine may be caused by direct violence, but more frequently by its being bent forcibly forwards, as when a weight falls on the back of the head and neck, or between the shoulders; the same effect may be produced by a fall, when the body is doubled up. Usually the body of a vertebra is fractured horizontally, the intervertebral fibro-cartilage torn, and the arch with one or more of the processes broken. Such injury almost invariably occasions lesion of the cord from encroachment on the spinal canal. The most frequent seat of fracture is towards the lower dorsal region, where the effect of the leverage is most felt. The bony injury is reparable, if the patient survive the nervous lesion. Perfect rest in the recumbent posture is essential, without interference with the seat of fracture. Operations for elevating depressed bone are unavailing. Fracture of the odontoid process may result from injury or disease, without necessarily proving fatal, if the moderator ligaments retain their integrity. (For nervous symptoms and their treatment, see "Injuries of the Nervous system.")

Sternum.—This bone forms the front boundary of the chest, and is much protected from injury by the yielding nature of the elastic ribs by which it is supported on either side. Fracture from direct violence is therefore rare; and, when it occurs, is not unfrequently attended with similar injury to the ribs, and consequently severe or even fatal injury to the contained viscera. Fracture is more frequently consequent on indirect violence, the body being bent forcibly forwards or backwards. Usually there is no displacement, because of the surrounding bony and ligamentous connections; and the only treatment required is rest, and a flannel bandage firmly applied.

Ribs.—The ribs are usually broken by pressure tending to alter their curve; and most frequently give way a little in front of the angle. The displacement is greater where many ribs are fractured, but the treatment is the same. Besides the pain and dyspnœa, crepitus may usually be elicited by placing the hand on the seat of injury, whilst the patient breathes. As the fracture from pressure almost always takes place outwards, the lung is not often wounded. Attention should be paid to any irritating cough, and a broad flannel bandage must be firmly applied around the chest. If the lung be wounded, air will escape either into the external areolar tissue or into the pleura. In the former case it is unimportant and will subside spontaneously; in the latter the accumulation of air may so compress the lung as to necessitate tapping the chest for its relief; but this is very rarely required. Hæmorrhage into the pleura is very rare. Pleurisy or pneumonia may occur, but are generally local. (See also "Injuries and Diseases of Viscera of Chest.")

Pelvis.—As the chest is protected by its elasticity, so the pelvis depends for defence from external injury upon its form, massiveness, and solidity; conditions which are essential for the support and transmission of the superincumbent weight. Fracture of the pelvis, therefore, occurs only as the result of great violence directly applied, such as a heavy fall, or the violent contact of a heavy weight. These fractures may involve the acetabulum, or be limited to the crest of the ilium, the body of the pubes, the ramus of either ischium or pubes; and they may exist with or without displacement. The diagnosis is by abnormal mobility and crepitus. *Treatment*, by entire rest, and attention to symptoms as they arise. The danger of injury to important organs is great, especially to the urethra in fracture under the arch of the pubes. Therefore at once pass a catheter if this be suspected, and keep it in the bladder if there be laceration. In fracture of the sacrum, paraplegia may exist from compression of the sacral nerves. (See also "Injuries, &c., of Viscera of Pelvis.")

Clavicle.—The more extended movements of the shoulder have the sternal end of the clavicle for their pivot; therefore this bone is often broken from violence applied indirectly, by falls on the hand, elbow or shoulder, as well as by compression of the shoulders, or by direct violence. Fracture is generally single, sometimes comminuted, scarcely ever compound. Pressure on the axillary vessels or nerves may occur. The amount of displacement varies according to the position of fracture, being greatest when in the centre: the weight of the arm and the loss of support between the scapula and sternum are the chief causes of displacement; therefore, the arm should be raised and supported, being carried backwards and outwards from the side. This may be accomplished with a figure of eight bandage, a pad in the axilla, and a sling to include the elbow. Special apparatus is required in some instances.

Scapula.—The most exposed parts of this bone are most often fractured: the spine, the acromion and coracoid processes, the inferior angle; the body and superior angle are also sometimes broken. These fractures are usually produced by direct violence, and are rarely compound. The glenoid cavity may be split by force communicated through the humerus. Fractured neck is described. Diagnosis from mobility and crepitus; displacement generally limited. *Treatment*, by rest and figure of 8 bandage. The arm to be supported in a sling and fixed to the side.

The *Humerus* may be fractured at various parts from direct or indirect violence; viz., through the shaft, the neck or tubercles, or just above the condyles; vertically, separating the condyles; or by the isolation of one or other condyloid process. In simple fracture of the shaft, use four splints, placing the hand in a sling and excluding the elbow; get the patient up. Comminuted fracture requires a dish splint and the recumbent posture for a time. In fracture into the elbow-joint, the joint itself should be enveloped in softened gutta-percha or leather, and thus fixed at a right angle: passive motion should be resorted to at a tolerably early period. In fracture of the neck, the deformity is similar to that consequent on dislocation into the axilla; but may be distinguished by its almost invariably following direct violence, by the shortening of the limb, crepitus, the presence of the fractured extremity of the shaft in the axilla, and the greater mobility of the limb. Treat by a shoulder splint of wood, leather, or gutta-percha with a pad in the axilla, and a sling to support the whole member.

Forearm.—The relative size and importance of the upper part of the ulna, and of the lower part of the radius, render these extremities of the bones, severally, more liable to fracture. Thus, either or both bones may be broken in the shaft; but, of the ends, the olecranon or coronoid process of the ulna, and the base of the radius, are most usually fractured. In broken shaft of either or both bones, padded or convex splints must be used to keep the bones asunder. In broken olecranon, the arm should be kept nearly straight, and fixed in this position with a splint; union is usually ligamentous. In fracture of the coronoid process the elbow must be flexed. The carpal extremity of the radius is often broken through by a fall on the palm of the hand; this accident, from the resulting deformity, is frequently mistaken for dislocation at the wrist. The hand should be fixed in an inverted position, or hanging down beyond the extremity of forearm splints, with the thumb upwards. Sometimes the carpal epiphysis of the radius is separated in young persons. The head of this bone, or the carpal end of the ulna, or the styloid process of either, may be likewise broken off.

Carpus.—The carpal bones may be fractured by the fall of a heavy weight on the wrist, the bursting of a powder-flask in the hand, &c. Such injury is generally attended by severe laceration, necessitating amputation.

Metacarpus.—One or more of these bones may be broken by (usually) direct violence. The hand must be kept at rest on a suitable splint.

Phalanges.—Fracture of the phalanges is commonly the result of great violence, and often demands amputation. Care should be taken, however, to sacrifice as little of the hand as possible. When these fractures are simple, they may be treated with pasteboard splints.

Femur.—In the child the neck of the femur is short and less oblique than in the adult, and the acetabulum is shallower; therefore fracture of this part is rare at an early age. The thigh is most usually broken in the middle third of its shaft, and the fracture is more often oblique than transverse: there may be double or comminuted fracture. Compound fracture is rare because of the thick pad of muscles, and therefore proportionably dangerous. Direct violence is a more frequent cause than indirect. The symptoms are loss of support, deformity, crepitus. The neck of the femur may be fractured within or external to the capsule, or at its junction to the trochanters. Fracture may also extend through the trochanter major. The symptoms are, shortening with eversion, free mobility with extensibility (which especially distinguishes it from dislocation), and crepitus. If inverted, which is rare, it is the effect of impaction of the fractured end. This accident occurs most commonly in advanced life, and as the consequence of a blow, in falling on the great trochanter. The condyles may be separated from the shaft, or split asunder longitudinally. Most fractures of the thigh do best with a long, outside splint, with a foot-piece, and an extending perinæal bandage. The exceptions are, where the fracture is just below the small trochanter, in which case the thigh must be bent on the pelvis, in consequence of the tendency of the psoas muscle to tilt the upper fragment. When the condyles are broken off, the semiflexed position is often preferable, as the gastrocnemius displaces them backwards. Fracture of the neck, if firmly united, entails more or less shortening. In aged people fibrous union alone can be expected; and the best treatment in such cases is to place the patient on a double-inclined bed, and confine the feet and legs for a time.

Patella.—This bone protects the knee-joint, and acts as a sesamoid bone in the extensor tendons. It may be broken in various directions, but almost always transversely, and apparently by muscular action, the fall which accompanies the accident being the consequence and not the cause of the injury. The amount of separation of the fragments is proportioned to the degree of laceration of the fibrous capsule. External violence may break vertically or star this bone. Compound fracture is very rare, but very serious. Position is everything in the treatment of these fractures. The whole limb should be raised or suspended, so as to extend the knee and flex the thigh on the pelvis. A knee-cap of gutta-percha may be moulded over the front of the sound knee, and the part corresponding to the patella being cut out, the mould may be adapted so as to include the fragments of the broken bone. Union by bone is rare, and not important. It is, however, important to limit the amount of intervening fibrous tissue, therefore great care should be taken to keep the knee extended, even for some time after the patient is permitted to get up, otherwise wide separation may subsequently ensue.

Tibia and Fibula. — One or both bones may be broken; the tibia less frequently alone, the fibula often. The tibia is usually fractured at its weakest part, viz., in or near its lowest third. It may be also broken near its head, or into the knee-joint, or close to its base, or into the ankle-joint, or the malleolus may be knocked off. The usual direction of fracture in the shaft is downwards, forwards, and inwards. Comminuted or compound fractures of the tibia are not infrequent. The fibula alone may be broken at any point, but most usually a little above the malleolus, from a twist of the foot. When high, the fracture is obscure, from the thick pad of muscle which surrounds the bone. When both bones are broken, the fibula is often, perhaps generally, fractured secondarily and at another part. These injuries may result from direct violence, but more frequently occur from indirect force, as in a fall. The symptoms are those common to all fractures. The complications attending these fractures are, that either the knee or ankle-joints may be implicated; that, when either or both malleoli are broken off, the foot may be dislocated inwards, outwards, or forwards, by muscular action. Dislocation of the foot forwards *with* the lower fragment of the tibia may occur in fracture near the joint, and simulate true dislocation, requiring division of the tendo Achillis to neutralize this effect of its spasm. A fragment of the tibia is sometimes torn off with the lower part of the fibula, and fracture may extend into the joint. Laceration of an artery is a rare complication of simple fracture, but more frequent in compound.

Treatment.—In simple fracture of one or both bones, if practicable, place the limb, semiflexed, on an outside splint; if not thus amenable, semiflexed on a back splint with a thigh support; or straight, with a long outside splint, and one to support the calf. In compound fracture with protruding bone, if necessary, enlarge the opening, or saw off the extremity of the fragment, or do both. Remove quite loose fragments. Bleeding from torn saphena vein may be stopped by a pad. The gastrocnemius tendon may require division if its spasm resist adjustment, but this should not be undertaken lightly, and is best deferred till the early effusion has been absorbed. Compound fractures into the ankle-joint often do well. (For remarks on amputation in compound fracture of the leg, see *ante*, p. 63.)

Tarsus.—The astragalus may be fractured by being jammed between the tibia and calx. A fragment may be displaced and even require removal. The tuberosity of the os calcis is sometimes broken off by the combined operation of a fall on the heel and muscular action; it is a rare accident, and must be treated by keeping the knee flexed and the foot extended.

The *Metatarsus* is occasionally fractured by the fall of a heavy weight on it, or the passage of a wheel over it. Entire rest, on a suitable splint, is all that is needed.

Phalanges.—The fracture of these bones is generally attended by severe laceration of the soft parts, requiring amputation. As little as possible should be sacrificed, and the great toe should be the chief object of care.

DISEASES OF JOINTS.

All of the textures which enter into the composition of joints, viz., cartilage, synovial membrane, ligaments, and cancellous bone, are liable to disease, which may be either primary or secondary. (For pathology of the several tissues, see *ante*, pp. 50, 54.)

Synovial membrane.—Synovitis may result from injury or exposure to cold, or may be secondary to disease of contiguous tissues, as of ligaments or bone. It may be acute or chronic. In the former, the symptoms are pain, swelling from effusion accompanied by fluctuation; suffering, increased by movement; heat, and sometimes redness of the skin. This condition may terminate by resolution, by effusion of inflammatory products, as lymph, or by suppuration. The *treatment* consists in absolute rest, leeches in the early stage, with warmth and moisture, or, if more agreeable, an evaporating lotion. It is often difficult to determine the presence of pus, and much discretion is requisite in making an opening into a joint; a grooved needle may sometimes be used with advantage. Pus, if present, should be evacuated.

The knee-joint is most obnoxious to synovitis, from its exposure to violence and cold. Such an attack is to be distinguished from inflammation of the bursa over the patella by the position of the swelling, which is lateral in the former, central in the latter. The constitutional symptoms in acute synovitis are often severe.

Chronic synovitis generally entails more or less permanent effusion—hydrops articuli. This may be treated with blister and iodine. Rest is essential: support, pressure, friction, the cold douche, are useful adjuncts. In some cases the fluid has been withdrawn from the knee-joint, and a solution of iodine injected. These affections are often associated with a rheumatic diathesis.

If anchylosis be anticipated as a sequence of synovitis, it is most important to attend to the position of the affected limb.

Appearances on dissection.—Acute inflammation is followed by plastic effusion, which adheres principally to the loose parts of the membrane, the latter becoming swollen and opaque; the surface then becomes villous and uneven, and after long-continued disease very thick and vascular. All these results may be secondary on caries or necrosis, as seen in cases of resection of the knee-joint, the whole articulation and contiguous tissues being involved and perishing.

Cartilage.—Erosion or destruction of cartilage, as a primary affection, is probably rare, if it ever occurs. Such destruction always involves either the superjacent synovial membrane or the subjacent bone, and appears to be a disintegration of texture consequent on fatty degeneration, and not interstitial absorption. If the diseased action be limited to the cartilage and superjacent synovial membrane, reparation is effected by the production of a smooth, hard surface on the bone itself, like porcelain (eburnation). Ulceration (so-called) of cartilage is usually secondary on caries of cancellous bone, or from the extension of mischief from a sequestrum in the epiphysis. Acute inflammation and suppurative destruction of the joint ensues as soon as the cartilage is perforated. In this condition excision is often demanded. The same result may, however, ensue, as a sequence of wound, or of acute inflammation of the external appendages of a joint.

The *treatment* consists in the employment of counter-irritation before suppuration has taken place; the moxa made by caustic potash is the best. If abscess exist, the joint must be opened by a sufficiently free incision to ensure the egress of the pus. If reparation occur, it is by anchylosis, in which case position is very important. If not supported, there is a tendency to dislocation, as in the hip from loss of texture and muscular action; in the knee, principally from gravitation.

Ligaments.—The internal ligaments of joints are involved in the destructive inflammation of synovial membrane and softening of cartilage. This disorganizing process necessarily precedes the spontaneous dislocation which occurs in the later stage of knee and hip disease. External articular ligaments are the seat of gouty and rheumatic inflammation; also from violence and cold they become inflamed, such attacks being accompanied by acute tenderness, some swelling, and subsequent thickening around the joint. This tenderness is best elicited by extension; the interior of the joint may be secondarily affected. Treat by constant and perfect rest, leeching and blistering at first. These attacks are often very tedious, and are serious when they extend to the articular cavity. The wrist is frequently the seat of this affection.

Cancellous bone.—The articular ends of bones are the seat of primary disease, especially in the young. Caries succeeds inflammation usually; the cartilage is next involved, and finally the interior of the joint is invaded. A sequestrum may be the nucleus from which all this mischief spreads. A joint thus disorganized presents purulent infiltration, probably finding an exit at one or more spots, an erosion or separation of cartilage, destruction of synovial membrane and ligaments, with carious cavities in the expanded cancellous structure. This primary affection of cancellous bone is often associated with the tubercular diathesis, and may be illustrated by knee or hip disease.

In *scrofulous* patients articular disease generally assumes a chronic type, with feeble reparative power. Cancellous disease will thus travel from bone to bone of the tarsus, guided by the synovial membrane or by contiguity. In this form of caries, affecting the neighbourhood of joints, the disease is insidious, causing little pain till the joint is invaded; as pus forms there are swelling, sharp pain, and spasmodic twitchings. Dislocation, and consequent distortion, are the consequences of spoiled ligaments, and interstitial softening and removal of bone; then spontaneous reparation may ensue. The early symptoms of this chronic form of scrofulous *hip-joint* disease are often overlooked; and even the symptomatic fever accompanying the acute form is frequently misinterpreted. Slight lameness, with pain in walking, attracts attention. A shock conveyed through the limb, or rotation whilst the articular surfaces are pressed together, induces pain. To ease the limb, the pelvis subsequently becomes tilted, producing apparent lengthening; the nates are flattened, the limb shrinks, and the groin is tender and swollen, aching pain being referred to the inner side of the knee. Suppuration follows, and pus is discharged at one or more points; dislocation upwards and backwards occurs (rarely forwards); the limb is shortened, and the patient becomes the victim of emaciation and hectic.

The *treatment* of such a case must be chiefly constitutional. (See "Scrofula.") Perfect rest must be enjoined, and the limb placed in the most favorable position, either by the employment of a long, outside splint, if it can be borne, or one of leather or gutta percha moulded to the hip and thigh. Counter-irritants, such as blister and moxa, are useful in the early stage, but not available at a later. In some of these cases the necrosed head of the bone remains as a sequestrum in the acetabulum, requiring operation for its removal. Excision of both hip- and knee-joints is sometimes applicable in this form of disease, and successful, if cases be selected judiciously.

Cancer affects joints as it affects bones. See "Diseases of Bone."

Hysterical neuralgia of joints is often very deceptive: it is marked by the temperament of the patient, the intermittent and shifting character of the pain, which is complained of on the slightest pressure; and the joint may be even slightly swollen and hot, but not continuously so. The patient's rest is not disturbed, and, if the attention be distracted, even rough manipulation can be borne. The treatment is that of hysteria generally.

Anchylosis.—This may occur in two forms; the more common is that in which fibroid tissue replaces the normal textures which have perished under destructive inflammation, whereby the adjoining bones are bound together both externally and internally, so as to limit or annihilate motion. In the second form the union is by bone, which may be either partial or complete. Anchylosis is often the most favorable result that can be looked for in joint-disease; and in such case it is of the utmost importance that the affected limb should be placed in the most convenient position: the knee nearly straight; the elbow at right angles. If these positions were reversed the several limbs would be comparatively useless. The utmost discretion should be exercised in attempting to alter the position of an anchylosed limb. Forced extension may be available where there is motion: this may be gradual; or immediate under chloroform. In the latter case it may be necessary to divide obstructing contracted muscles or tendons. In bony anchylosis of the knee at a right angle, a wedge-shaped portion of bone has been sawn out and the limb straightened. This is a serious proceeding.

INJURIES OF JOINTS.

SPRAINS.—These injuries result from force tending to produce dislocation, but stopping short of that effect. The condition in a sprain, as of the ankle, is, that the ligaments, capsule, tendons and their sheaths are stretched, and sometimes partially lacerated; blood is extravasated, constituting ecchymosis, and the joint becomes puffy from effusion into the capsule. The *treatment* consists chiefly in perfect rest and a favorable position, as the horizontal posture when the leg is the seat of injury. Warmth and moisture, by fomentation and poultice, are generally more agreeable to the patient; but there is no objection to evaporating lotions if preferred. A few leeches may be of service. In the later stage friction, with carefully applied support, should be employed; the cold or tepid douche is often a valuable auxiliary: but above all, forbid early use of the injured joint, remembering that, under favouring circumstances, sprains often lay the foundation of serious disease, if neglected; they often leave permanent thickening. Ligaments are occasionally quite torn through, and the result is, probably, permanent weakness of the joint; as where the internal lateral ligament of the knee gives way. Support must be supplied by a strong elastic or laced knee-cap.

DISLOCATION.—By dislocation is meant the displacement of the articular surface of a bone from its normal position. This may be produced, like fracture, in three ways:—1. By direct violence acting on the bone near to the joint. 2. Indirectly, the bone itself being acted on as a lever. 3. By muscular action. The first and last are rare without the aid of the second; and in each of the first two the muscles generally aid importantly. The following axioms may be laid down in reference to muscles, as bearing upon dislocation: 1. They preserve joints in their normal relation. 2. They aid in producing dislocation when the position of the bone favours it. 3. They retain the displaced bone in its abnormal position. 4. They assist, under judicious management, in the reduction of dislocation. Atmospheric pressure is also, doubtless, influential in preserving the integrity of joints.

Conditions.—Dislocation, when complete, generally involves laceration of ligament, of muscle or tendon, or of the capsule of the joint, and extravasation of synovia.

The *Symptoms* are—deformity, resulting from displacement and muscular spasm; swelling, from effusion of synovia, serum and blood; immobility from the same causes as deformity; pain from tension, and abnormal pressure on nerves, and laceration of neighbouring tissues.

The *Causes* of dislocation may be predisposing, as from paralysis of muscles, disease of joints, laxity of ligaments, previous displacement; under which circumstances very trifling external violence is sufficient to produce dislocation. The exciting or immediate cause of dislocation is force applied as already noticed.

The characteristics which distinguish dislocation from fracture are—immobility, absence of crepitus, and permanence of the deformity. But it must be remembered that in old people, and where the muscles are flaccid and feeble, a dislocated limb is more readily movable; and that, even under other circumstances, rigid, tonic spasm does not always occur until the lapse of some hours after the injury is received. Further, the crepitus of effusion must not be mistaken for that of fracture. These remarks apply especially to the deep, *i. e.*, the ball-and-socket joints. Dislocation may be complicated with fracture, in which case the diagnosis is most obscure.

Treatment.—Dislocation should be reduced as soon as possible. The indications are—to overcome muscular spasm, and to *help* the muscles to restore the bone to its normal position; therefore, the direction of the dislocation should be carefully borne in mind, and the force and manipulation directed accordingly. If the patient be still sick and faint from the injury, so much the better. With the aid of chloroform pulleys are rarely needed, and bloodletting and tartar emetic have been superseded. Extension may be carried too far, even to preventing reduction, and risking the laceration of arteries, nerves, muscles, or fracture of the bone. Rotation, flexion or extension, as the case may demand, must be practised whilst the muscular action is being overcome; and the dislocated bone should be drawn, raised, or lowered into its right place. If the patient be conscious, his attention should be distracted by directing him to perform some other movement. Reduction is indicated by restored symmetry, normal mobility, and relaxation of previously tense muscles: an audible snap accompanies, in some instances, the reduction of a dislocated ball-and-socket joint, and occasionally so in others.

After what interval may reduction of dislocation be attempted? This question cannot be answered unconditionally. The age, sex, health and wish of the patient, as well as the form of the joint, and the degree of impaired or recovered use of it, must all constitute elements for consideration. No doubt many dislocated bones have been reduced after a protracted interval. But it must be remembered that, after a time, the normal cavity may be partially or entirely filled with inflammatory effusion; the form of the displaced head may be changed; or the muscles may be permanently shortened: moreover, a new articulating cavity may be formed or in process of development. As a rule, it is certainly better to leave a long-dislocated bone unreduced, than to incur the risks accompanying an attempt to reduce it by the employment of great force.

Compound dislocation is a complication which is serious, for the same reasons as apply to a similar aggravation attending fracture. But, in the former, a wound communicating with the joint is still more important on account of the sympathetic constitutional disturbance entailed, and the risk of future disorganization or loss of movement, from inflammation and its consequences.

PARTICULAR DISLOCATIONS.

The *lower jaw* may be dislocated, both condyles being usually thrown forward by muscular spasm, especially of the external pterygoid, when the mouth is widely open, as in gaping. One condyle only is occasionally, though rarely, dislocated. The jaw is projected and the mouth open, the patient being unable to articulate. Where dislocation has once taken place, it is apt to recur, and may be renewed by very trifling causes where the ligaments are stretched or the joint is diseased. To be reduced by placing the thumbs, well protected, on the back teeth, and pressing firmly downwards and backwards. The occurrence and reduction of this dislocation is a simple but clear illustration of the axioms referred to above, respecting the influence of muscular action in the production, continuance, and relief of dislocation.

Vertebræ.—Simple dislocation of these bones, generally, can scarcely occur; but it is accompanied by fracture of the articular processes, of the arch, laminæ, or body of the vertebræ, or rupture of the intervertebral fibro-cartilage. (See "Fractures of Vertebræ," and "Injuries to Nervous system.") The strength of the ligamentous connections between the head, atlas, and axis, renders these dislocations almost impossible without disease existing. If diseases of ligament or bone allow of the head being partially and gradually dislocated from the atlas, anchylosis may follow, and the patient survive; or death may be sudden.

Cases are recorded of the second vertebra being dislocated from the first laterally or backwards, without disease, the ligaments being of course ruptured. When the moderator ligaments are torn through, the odontoid process may slip under the transverse ligament; this was supposed to be the explanation of a case in which a struggling child was raised by the head; although, anatomically, it seems almost impossible.

Ribs.—These bones are never dislocated except when weakened by disease: force applied so much more readily breaks them.

Pelvis.—Dislocation is rare in consequence of the character and strength of the articulations, and can result only from the application of great violence, which is usually fatal from other injuries which it entails. The sacrum may be forced forwards, or one ilium separated at its synchondrosis; or the ossa pubis may be separated: but these injuries are rarely simple. Prolonged rest is imperative.

The *clavicle* may be dislocated at either extremity, but more often at the acromial end. Either displacement involves extensive laceration of strong ligaments. The *sternal* end is usually driven forwards and upwards, by force indirectly applied through the shoulder. The position of the displaced bone is sufficiently apparent, as it is superficial. If the shoulder be raised and carried backwards, it can be replaced; but dislocation again occurs unless this position be maintained by treatment similar to that applicable to fracture: the arm must be fixed to the side, with a pad in the axilla, and the shoulder drawn back. Dislocation backwards is a very rare but serious injury, from pressure on the thoracic outlet: it would probably be the consequence of direct force; and would require similar treatment for reduction. Dislocation of the *acromial* extremity upwards entails loss of power and deformity, similar to fracture near to this end of the bone, for which it is often mistaken. Its treatment must be the same; but the cure is much more tedious. The movements of the arm are not seriously curtailed in permanent dislocation of the clavicle.

Humerus.—The head of the humerus may be dislocated from its shallow cavity downwards, forwards, or backwards. This accident is almost invariably the consequence of indirect violence, as in a fall on the elbow or hand, the arm being outstretched and separated from the side: this position is favorable for the powerful muscles near the joint to drag the bone downwards into the *axilla*, the greater part of the articular head being already out of the glenoid cavity in this direction. The forward, or *subpectoral* dislocation is usually secondary, occurring not infrequently in the attempt to reduce the axillary dislocation. In the *dorsal* dislocation, which is very rare, the direction of the force and position of the arm determine the direction of the displacement. In all, the capsule and capsular muscles are more or less lacerated, and there is consequent effusion.

The signs of axillary dislocation are, sinking of the deltoid and prominence of the acromion; the arm being somewhat lengthened and separated from the side. The patient supports it to assist in relieving pressure on the axillary nerves. Pain, numbness and swelling, result from pressure in the axilla. Mobility is limited in this as in the other dislocations; and the head of the bone may be felt in its abnormal position on the outer border of the scapula, if the humerus be raised from the side. In the forward dislocation, the arm is somewhat shortened, and the elbow directed backwards and outwards. The head of the bone may be seen or felt beneath the pectoral muscle. In the backward dislocation the head of the bone is seen or felt beneath the infra-spinatus muscle, and the elbow is directed forwards. A partial dislocation may occur, in which the head of the bone rests against the outer side of the coracoid process. Reduction is to be effected by fixing the chest, and making extension. In the axillary dislocation, the patient may be seated; and a jack-towel, passed around the chest and including the scapula, is held by an assistant: extension is then to be made at right angles from the body; and the operator's knee in the axilla (the foot resting on the chair), is to be used as a fulcrum, when the arm is depressed: or, the patient and surgeon both being recumbent, head to heel, the latter places his unbooted heel in the axilla, whilst he makes extension from the forearm. Other methods have been suggested, but one of the above almost always succeeds. In the forward dislocation, extension should be made downwards and backwards; and the backward dislocation is reduced by extending the arm downwards and forwards, or by elevating it. The arm should be subsequently fixed to the side and supported.

Dislocation into the axilla may be confounded with fracture of the neck of the humerus: they are to be distinguished by the determining cause of the accident, which is usually direct violence in the latter, indirect in the former: further, in fracture, the limb is more moveable, the fractured extremity of the shaft may be felt usually in the axilla, at the same time that the limb is shortened, and the rotundity of the shoulder may be partially restored by manipulation and preserved whilst it is supported. But it must be remembered that the laxity of the muscles in the aged renders a dislocated limb far more movable than in the young and robust. Dislocation may be complicated with fracture of the neck, but these cases are rare.

Elbow-joint.—The most common dislocation at this joint is that in which both bones of the forearm are thrown backwards and upwards. The limb is therefore shortened, bent, fixed, and deformed by the prominence of the olecranon behind the condyles of the humerus. Though usually described as a sufficiently complete dislocation for the coronoid process (if not broken) to rest in the posterior depression on the humerus, probably this is rarely the case, and is then most likely attended by considerable muscular laceration, especially of the brachialis anticus. This accident is usually the consequence of a fall on the palm, the arm being outstretched, but the elbow somewhat bent, as in coming to the ground on the hands in playing at leap-frog; and it is most commonly met with in the young. When recent, the reduction is not difficult, and may be effected by forcible flexion of the arm with the knee in the hollow of its bend; or by extension of the forearm and counter extension of the humerus. Both bones may be dislocated laterally, though this is, relatively to the last, a rare accident. When driven inwards, the head of the radius usually falls into the posterior fossa on the base of the humerus: in the luxation outwards, the coronoid process of the ulna rests on the outer condyle. The reduction is to be effected in the same way as in the former, the bones being at the same time pressed into their position. These lateral dislocations are necessarily incomplete.

The head of the *radius* may be dislocated alone, either forwards or backwards, the latter being very rare. The deformity is well marked; and the head of the radius can be felt, in its abnormal position, when rotation is attempted. These accidents are caused by a fall on the palm, whilst the arm is extended; and in both the arm is somewhat bent and prone, and its mobility limited. Reduction is to be effected by extension through the hand, that is, upon the radius, the displaced head being at the same time pressed into position.

The *ulna* alone may be displaced backwards or backwards and inwards; but this is a very rare accident.

In all these dislocations at the elbow-joint, there is necessarily much laceration of ligament, which renders the retention of the radius, when reduced, very difficult: and the chance of complication with fracture should not be lost sight of. In attempting reduction, the attachment of the muscles, especially of the biceps, brachialis anticus, and triceps, should be remembered. Reduction should be effected as soon as possible, because of subsequent difficulty. Rest should be secured and rigidly enjoined for several days; and then passive motion should be cautiously commenced.

Wrist-joint.—Dislocation of the carpal end of the radius is described; but it is doubtful whether this ever occurs except in a diseased wrist. Cases so described appear to be (at least generally) fractures of the bone near to the joint. Probably the resistance of the large mass of flexor tendons, in a state of tension, prevents this displacement. The carpal extremity of the ulna may be dislocated either backwards or forwards—the latter very rarely—and then appears, loose and prominent, the interosseous fibro-cartilage being lacerated. This dislocation is not very difficult to reduce, but it readily recurs if the joint be not carefully secured.

Carpus.—The head of the os magnum has been dislocated from its cup-shaped cavity. Simple dislocation of the metacarpus from the carpus could scarcely occur.

Hand.—Dislocation of the phalanges of the fingers or thumb is usually produced by violence acting on their palmar surface, aided by muscular action: the displacement being generally of the distal phalanx on the back of the proximal. Reduction is effected by extension, with the assistance, if necessary, of a tape noose, and by pressure with the finger and thumb of the operator. If left unreduced, these dislocations soon obstinately resist reduction: division of the strong lateral ligaments may be justifiable under these circumstances. Displacement of the proximal phalanx of the thumb on to the back of the metacarpal bone is difficult to reduce; extension should be made across the palm. A door-key, guarded with lint, and passed over a dislocated joint, may be used as a lever in reducing these dislocations of the fingers. Dislocation of the first phalanges of the fingers on the metacarpal bones is rare, and could scarcely occur except backwards.

Hip-joint.—The relation of the trochanter major, the anterior superior spine of the ilium and the pubic spine, as the angles of a triangle, should be carefully studied in connection with the displacements of this articulation. Dislocation of the hip may take place in four directions, and each is determined by the position of the limb at the time of the accident, and the direction in which the force from without is applied, aided by muscular action. Thus the forward dislocations are most likely to occur when the femur is so rotated and abducted as to throw a considerable portion of the fore and inner part of its head out of the acetabulum. Therefore, we generally find that the thighs are widely separated when the head of the femur is thrown into the thyroid foramen: that a similar position, with rotation outwards, favours displacement on to the pubes, whereas, in both the backward dislocations, on the dorsum ilii and into the ischiatic notch, the accident occurs when the limb is rotated inwards and thrown across the other.

In the *Dorsal* dislocation the limb is shortened from one to two inches and a half, according to the degree of elevation of the displaced head; it is inverted considerably; the roundness of the hip is diminished, whilst that of the buttock is increased; the head of the bone may be usually felt in the latter place when rotation is attempted. The small rotators which clustre around the joint, the round ligament, and the capsule are torn.

The *Ischiatic* dislocation is a modification of the last in respect of all its signs, and is attended by similar lesion. The limb is less shortened and inverted, and the prominence of the buttock but trifling, as the head of the bone sinks into the ilio-ischiatic notch, between the pyriformis muscle and the sciatic ligaments. The consequence is that this dislocation is more likely to escape detection than any other; it is sometimes a secondary dislocation, produced by ill-directed efforts to reduce the dorsal or thyroid form.

In the *Thyroid* dislocation the limb is lengthened from an inch and a half to two inches, and advanced with the toes directed forwards; the trochanter is much sunk, and the body is bent forwards to relax the stretched psoas and iliacus muscles; the limb cannot be carried over the other. A prominence towards the perinæum may be felt, but the displaced head of the bone is thickly covered by the adductor mass of the muscles in its new position.

In the *Pubic* dislocation the head of the femur rests on the body of the pubes, under Poupart's ligament, and external to the femoral vessels, where it may be felt and seen; the limb is a little shortened and everted, and cannot be rotated inwards.

Treatment.—In reducing these dislocations, extension must be made in such direction as to favour the co-operation of the muscles in accomplishing the reduction, at the same time that the limb is rotated so as to present as much as possible of the head of the femur towards the acetabulum. But, as in both the thyroid and ischiatic dislocations, the head of the bone rests in a depression, it generally requires to be lifted directly out. Therefore, dislocation on to the dorsum ilii must be reduced by extension across the opposite limb, and then rotation of the thigh outwards. In dislocation into the ischiatic notch, extension must be made in the same direction, with similar rotation at the proper time, the head of the bone being likewise lifted out of its abnormal position, if necessary. In the thyroid dislocation extension should be made downwards and outwards, the upper part of the limb being drawn outwards, whilst the foot is forcibly adducted. It is in reducing this dislocation especially that there is a risk of conversion into an ischiatic dislocation by carrying the limb forwards. The pubic dislocation is to be reduced by extending the limb backwards, and then raising it into position, whilst it is rotated inwards. Chloroform has superseded the use of pulleys in almost all recent cases, which may be generally reduced by the hand only.

The characteristics by which fractured neck of the femur is to be distinguished from these dislocations are, that though drawn up and everted in the former, the limb may be drawn out to its full length, and moved in various directions. Further, the presence of crepitus and the history of the accident rarely leave room to doubt the nature of this far more common accident, especially in the aged.

Knee-joint.—The *patella* may be dislocated either outwards or inwards, but usually the former. It is easily reduced, but is liable to reproduction, as the capsule must be lax or partially torn. To reduce it, the knee should be extended and the thigh flexed. The accident is not common. If the extensor muscle or ligamentum patellæ be torn or cut, the bone will rise or fall as the case may be: the cure, in either instance, necessarily requires protracted rest in a suitable position, as in fractured patella.

Dislocations of the tibia from the femur, either partial or complete, are rare. In either instance there must be more or less laceration of ligaments. Partial displacement to either side is not difficult to reduce, and is compatible with restored motion; but complete lateral or antero-posterior dislocation is necessarily accompanied by more serious mischief and consequences, involving, probably, the necessity of amputation, especially if the injury include laceration of the integuments: yet recovery from complete dislocation has been recorded.

The fibula can scarcely be dislocated from the tibia, unless the joints be diseased; it has been forced upwards.

Ankle-joint.—Though there is considerable lateral as well as antero-posterior movement at the ankle-joint, the malleoli are a great protection against dislocation, and are almost always fractured when it occurs. Displacement *inwards* or *outwards* are necessarily accompanied by fracture of one or both malleoli, or of the fibula above the malleolus; these injuries are not infrequently compound: the strength of the lateral ligaments secures them usually from laceration. Dislocation *backwards* of the tibia, in which that bone rests on the os calcis, is very rare; dislocation *forwards* on to the navicular bone is more common, and is marked by elongation of the heel and shortening of the instep: both are usually attended by fracture of the fibula or malleoli.

The forward dislocation may be partial, and is to be reduced by extending the foot, the astragalus being broader in front. Fracture may render this dislocation difficult to keep in position, in consequence of spasm of the gastrocnemius muscle; in which case its tendon might be divided. In all of these dislocations the limb must be placed in an easy position, in a long splint with a foot-piece, and the knee flexed. Even compound dislocations do well with care: in rare cases it may be requisite to remove a protruding portion of bone, to facilitate the adjustment.

Tarsus.—The astragalus is sometimes wrenched or jammed out of its place, being torn from its connections and thrown inwards or forwards on the navicular bone, rarely backwards. This injury may be simple, but the skin more often gives way, and there is extensive laceration of soft parts, and probably fracture of the bone itself: it is usually, but not necessarily, attended by fracture of one or both malleoli, or of the leg bones higher up. It is rarely of any avail to attempt reduction, should the state of parts justify the preservation of the foot. The displaced bone has been removed and a useful limb restored. Dislocation of other bones of the tarsus may occur, but they are rare; as of the anterior part of it from the astragalus and os calcis, or of the inner cuneiform bone: the reduction of such displacement must be difficult if not impracticable, unless dealt with immediately.

The *metatarsus* may be dislocated from the tarsus: such a case is recorded from the fall of a heavy weight on the foot; but fracture is much more likely to result from violence thus applied.

When the *phalanges* are dislocated, the injury is generally complicated and compound. The ungual phalanx of the great toe may be dislocated by muscular action, combined with external force: it should be reduced immediately.

INJURIES AND DISEASES OF BLOOD-VESSELS AND LYMPHATICS.

INJURIES OF ARTERIES.—Serious or even fatal hæmorrhage may result from ulceration, rupture, or wound of an artery. If practicable, a wounded artery should be secured at the seat of lesion, a ligature being placed above and below the point from which the blood issues; if impracticable, either a ligature must be placed on the supplying trunk, or it must be compressed above and at the seat of injury. A ruptured or ulcerated artery cannot usually be secured at the bleeding point: in such case, if styptics and compression fail, either the supplying trunk must be tied, or amputation (in a limb) be resorted to. A partially opened artery will often bleed more persistently than one entirely divided, because it can neither retract nor contract. A ruptured artery or burst aneurism may threaten life indirectly, by gangrene from general distension and obstructed circulation; under such circumstances the election lies between ligature of the arterial trunk, or amputation of a limb.

The consequence of ruptured or punctured artery, where the blood does not find an external vent, is false aneurism; and this may be either diffused or circumscribed. In the former, where the surrounding tissues are infiltrated, the treatment must be as just stated; in the latter, where the limits of extravasation are bounded and defined, and a circumscribed sac is walled in and lined after a time, the treatment is the same as for true aneurism. A penetrating wound, involving an adjoining artery and vein, is followed by one of two consequences, either the direct ingress of arterial blood into the vein, the latter being distended into a pouch (aneurismal varix), or by the formation of an intermediate sac, similar to that of circumscribed false aneurism (varicose aneurism). Uniform pressure, by bandaging at an early period, may arrest these results. If not, cut down and tie the artery above and below, if the sac be small; or if large, tie the artery above.

Healing process.—The action of a ligature upon an artery is to divide its middle and inner coats, leaving its outer or cellular coat intact. When an artery is entirely divided, it retracts, and its tube contracts as far as the next branch, if that be large and not far distant. An external plug of coagulum first forms in the arterial sheath, and then an internal plug in the canal, though this does not appear to be essential. The formation of this plug is probably due to the influence of diminished impulse by diversion of the current of blood, conjoined by the irritation of a ligature where such is applied. Inflammation of the cellular coat is followed by deposit of plastic matter and adhesion. Subsequent suppurative softening of the cellular sheath liberates the ligature: if this action extend to the neighbouring portion of the artery, secondary hæmorrhage ensues. (For further information, see "Hæmorrhage.")

Diseases of Arteries.—The absence of vessels in the elastic and lining coats of arteries, throws upon the cellular coat the task of healing lesions; this coat is, therefore, the seat of inflammation and its consequences. The redness and softening of the other coats is due to infiltration and inhibition; and the appearance of inflammatory product within them to transudation from the outer coat.

Inflammation of an artery is far more prone to terminate in adhesion than suppuration, and the result of arteritis, whether spontaneous or traumatic, is either adhesion with or without a plug, or simple plugging of the affected vessel by coagulum, and consequent arrest of the circulation through it. If, however, ulcerative softening with suppuration occur—which is of extreme rarity in idiopathic arteritis—hæmorrhage ensues. If arteritis attack the vessels of a limb, their contents coagulate, and mortification is the consequence. This condition is different from that in which a ligature is applied upon an artery; because in arteritis the branches as well as the trunk are plugged. The rarity of blood-poisoning in this affection is probably due to the infrequency of the suppurative termination of arteritis.

Ulceration of an artery is often consequent on extension of ulceration from contiguous textures, and causes sudden, and often fatal, hæmorrhage.

Atheroma is a degenerative action, commencing in the lining membrane, which becomes hypertrophied and opaque; fat-globules, albumen, and particles of calcareous matter being then deposited in it. Calcification is a later change, having the same texture for its seat. The aorta is most frequently thus attacked, but the arteries of the extremities, brain, heart, &c., are also liable to this degeneration; those supplying the liver and membranous abdominal viscera most rarely so. In the same order of frequency aneurism occurs.

Aneurism is not a restricted term, but is applied to the effects of injury as well as of disease. False aneurism, the consequence of injury, has been already noticed. Aneurism proper, or *true aneurism*, is a circumscribed dilatation of an artery, dependent on the loss of the elastic and contractile property of its coats, or of chronic inflammation of its cellular sheath. The simplest type of aneurism is that so frequently seen in the aorta, in which the dilatation is uniform and cylindrical, and includes the whole of the coats. But, after attaining a certain magnitude, the middle coat yields by expansion and separation of its fibres, allowing an abrupt projection of the inner and outer coats. This condition prevails in many instances at an early period, and then constitutes what is denominated the mixed or *hernial aneurism*. It is questionable whether the inner coat is ever rent; but on this point opinions differ.

Aneurisms thus formed usually contain coagulum deposited in laminæ, which is more abundant in the hernial form, because the sac is more removed from the direct current of the blood. Aneurisms are of various magnitude; many may exist in the same individual, and even in the same artery. As the sac increases in bulk, it presses upon, and causes absorption and other changes in, contiguous textures.

The natural tendency of this disease is to a fatal issue, either by inflammation and gangrene, or by bursting and fatal hæmorrhage. The latter termination is not limited to large sacs only; small hernial aneurisms are more prone to burst than large ones, because the fibrinous deposit is more scanty at an early period of the disease. When aneurisms in the extremities burst, it is usually the sequel of inflammation and suppuration. Internal aneurisms burst, spontaneously or under some sudden exertion, into the air-passages, œsophagus, pericardium, &c. Bone is absorbed under their pressure, as the sternum, where the aorta is the seat of the disease.

An aneurism may be cured spontaneously, though this is rare, by its compressing the supplying artery, by arteritis, or by the lodgment of a detached plug.

Accidental causes may determine aneurism, as in the extremities; a wrench or jerk or strain may thus act on an artery probably deteriorated in elasticity, by producing laceration of its inner or middle coat.

The *symptoms* of aneurism are the presence of a pulsating tumour, thrilling to the touch and ear, distending with each ventricular systole, and collapsing on pressure of the supplying trunk; accompanied, in the extremities, by pain, numbness, coldness, œdema and feebleness, dependent on pressure of neighbouring veins and nerves. A solid vascular tumour, or a tumour placed over a large artery, may convey pulsation to the touch; but it does not vary in size by emptying itself when the supplying trunk is compressed, and refilling when the pressure is removed. The rare occurrence of an artery opening into an abscess may lead to error in diagnosis and treatment. In all cases the history is an important element in the diagnosis of aneurism.

Cure of aneurism.—Before deciding on the course to be pursued for the cure of aneurism, many circumstances must be considered, such as the age and general health of the patient, his freedom from heart disease, and other aneurismal swellings, as well as the condition of the artery to be operated on. If the mode of treatment by pressure be determined on, it should be borne in mind that the object in view is, not to stop the current of blood through the sac, but to moderate it, so as thereby to promote the natural tendency to the accumulation of fibrinous deposit within it, and thus gradually obliterate it. The pressure, therefore, should be carefully graduated, varied in its position, and, if requisite, occasionally intermitted; the attention should be unremitting. Patients of excitable temper do not bear pressure well. The condition of the sac should be daily watched, as it is sometimes prone to suppuration under these circumstances. Pressure by forced flexion of the knee in popliteal aneurism has been found efficacious.

In tying an artery, the external incision should be free, but the vessel itself should be disturbed as little as possible. Care must be taken to exclude everything but the artery; and after ascertaining with certainty the connection between it and the sac, a strong ligature should be firmly tightened so as to cut through the middle and inner coats of the vessel. The wound should then be closed, leaving sufficient aperture for the escape of discharge, and carefully securing the ligature.

The period of separation of the ligature varies from ten days to three weeks or longer, according to the size of the artery, and its distance from the heart. In most cases the circulation is speedily re-established through collateral channels; for, though the temperature of a limb thus treated at first falls, it soon rises above the normal standard.

The risks attending ligature of an artery are, gangrene from inanition; suppuration of the sac; hæmorrhage at the seat of ligature. Gangrene may be limited, *e. g.* to the foot or toes where the femoral artery is tied; but if it extend, the only alternative is to amputate, at least as high as the artery is tied. In suppuration of the sac after ligature there is no risk of hæmorrhage; it must be freely laid open and treated as a foul abscess. Secondary hæmorrhage at the seat of ligature is the most dreaded risk; it occurs usually in the second week after the ligature is applied, and is the consequence of ulceration into an unsealed artery. It commences insidiously, but proves generally intractable. If pressure fail of arresting it, the artery should, if possible, be tied higher up, or the limb, in some cases, be amputated.

DISEASES OF VEINS.—*Phlebitis*, or inflammation of veins, is more often acute than chronic, and has its chief seat in the outer or cellular coat of the vessels. It may be primary, and the result of mechanical lesion, as contusion, puncture or ligature; or secondary, by extension from contiguous textures, or from the neighbourhood of an abscess.

The cellular coat of an inflamed vein is first injected and then infiltrated; and this condition involves the thin fibrous coat, the lining membrane also becoming discoloured and softened, by imbibing the exudations from the inflamed outer coat. A plug subsequently forms in the then dilated vessel, the products of inflammation meanwhile separating the coats, and being deposited in the interior of the vein, by transudation or perforation. The plug being softened or expelled, lymph or pus occupies its place; and, by mingling with the circulation, they poison the blood. Hence the constitutional phenomena which characterise this condition, and the secondary consequences in local external deposits of pus; or in pyæmia, where abscess occurs in the liver, lungs, or other internal organ. (For general symptoms of blood-poisoning, see "Animal poisons.") Local abscess may occur in an inflamed vein; and, being limited by plugging and obliteration of the vessel, is unaccompanied by symptoms attending absorption. Phlebitis may also terminate by simple thickening, dilatation or obliteration of the vessel.

Treatment.—By rest, leeches, warm applications; and open abscess early. Mild purgatives and general support, unless otherwise indicated.

Operations for obliteration of veins, by ligature or otherwise, is always attended with risk. It is necessary sometimes to tie veins in operations, as amputation. The admission of air into an opened vein is sometimes speedily fatal.

Dilatation of a vein, accompanied by thickening, is sometimes one-sided, and thus gives rise to a convoluted appearance, and what is termed varix. The valves cease to perform their office. This condition of varicosity is not always dependent on obstructed circulation alone, but may result from increased local action, as in malignant growths. When affecting the veins of the spermatic cord, it is termed varicocele; in the rectum, hæmorrhoids. (For further remarks on Varicose veins, see "Ulcers.")

Vascular tumours are sometimes formed by the dilatation of the minute arteries and veins and intervening capillary network: this is nævus, or erectile tumour. When the small *arteries* are chiefly the seat of this disease, it is accompanied by pulsation, and often extends to the larger supplying trunks. Such pulsating tumour is termed aneurism by anastomosis. There is a constant tendency, in all of these tumours, to grow. They often resemble, in texture, the erectile tissues.

Nævus is usually congenital, and grows rapidly. Its seat is either the skin or subjacent areolar tissue; and it appears in the former as a bright, slightly raised, scarlet stain; in the latter as a bluish swelling with a doughy feeling: both forms may coexist. Nævi occur on every part of the body and limbs, though, most rarely, on the hands and feet; sometimes they are single, at other times numerous. The free application of strong nitric acid or potassa fusa generally suffices for the cutaneous nævus; the subcutaneous disease requires the ligature, or injection, or the introduction of a probe armed with nitrate of silver.

Vaccination has been found useful; pressure or simple puncture is rarely effective.

In aneurism by anastomosis, the supplying arteries, and even the main trunk, have been tied ineffectually. Excision is dangerous. It is best to tie such a tumour in sections if large, first dividing the skin if it be not involved, and using cross pins, or ligatures without them. These pulsating tumours may occur in muscle, or occupy a finger, or the ear, &c., and are very intractable.

DISEASES OF LYMPHATICS.—These delicate vessels play an important part in many surgical affections, by removing fluid or solid deposits, the consequence of inflammation or other morbid action. Such effort may be promoted in various ways; *e. g.*, by internal medicine, as mercury or iodine; by the local application of the same; by friction or pressure. The last-mentioned influence operates spontaneously on surrounding textures, in the growth of tumours, in the bursting of aneurism or abscess. Poisons are taken up by the absorbents and veins.

Lymphatic vessels may become the seat of inflammation, and their ganglia of suppuration, resulting from simple irritation or the absorption of poison. Such inflammation is characterised by the bright scarlet lines, narrow and well defined, which indicate the course of the vessels; and may be distinguished from phlebitis by the breadth, hardness, and greater tenderness accompanying the latter, which is also usually slower in its development. Absorbent inflammation generally subsides spontaneously, but may terminate in suppuration or obliteration of the lymphatics. When suppuration occurs in the lymph-glands, generally the preceding inflammation of the vessels subsides, and with it the constitutional disturbance: such suppuration is probably the elimination, in many instances, of absorbed poison thus arrested, and the pus should, therefore, be speedily evacuated. (See also "Poisoned wounds.")

These little bodies are also the occasional seat of chronic enlargement and induration; also of tuberculous deposit, as in the mesentery; likewise of cancer, though more often as a secondary than as a primary formation. The thoracic duct is occasionally the seat of mechanical obstruction.

DISEASES AND INJURIES OF THE NERVOUS SYSTEM.

In *Hydrocephalus*, the fluid accumulates usually in the ventricles, which are distended and thinned; rarely in the sac of the arachnoid. This accumulation is sometimes very great, separating the bones widely and extending their membrauous connections. In such cases an operation has been resorted to, sometimes with permanent benefit. It consists in perforating the top of the head with a trochar and canula of small size, on one side of the median line, to avoid the longitudinal sinus. Support should be afforded during the withdrawal of a limited quantity of the fluid, and a bandage afterwards applied. This operation should be repeated at intervals, as the fluid is sure to collect again.

In *Spina bifida* the accumulation is within the sac of the arachnoid. Tapping in these cases is useless. Injection and the ligature have been tried; but both are usually highly dangerous, for inflammation cannot be limited; and the nerves may be included in the noose.

Nerves are atrophied by pressure, such as that of tumours, all nerve texture sometimes disappearing. When simply divided, nerves can reunite and their function is restored; not so when there is any considerable loss of texture. When the bulbous extremities of nerves, in an amputated limb, become adherent to a conical stump, their extreme sensitiveness may render resection necessary. Usually, however, they shrink and become atrophied. *Inflammation* of a nerve may result from injury, or exist as a rheumatic affection, or as tic. The function of the facial motor nerve sometimes becomes suspended from cold.

Cysts in nerves are rare. *Neuroma* is an adventitious deposit between the fasciculi of a nerve. These tumours sometimes attain a large size; their removal necessarily involves the destruction of the nerve. Tubercle is not deposited primarily in nerves; but they are the seat of both primary and secondary medullary cancer, as in the retina.

THE BRAIN, *injuries of.* (For fracture, see "Injuries of Bone.") *Concussion* or commotion of the brain is the immediate consequence of a blow or similar injury, and varies in intensity and duration according to the severity of such injury; in some instances being transient, in others lasting for hours or even days. The symptoms are prostration, indicated by a feeble pulse, cold skin, and slow breathing; stupor profound, but not complete; pupils inactive, and generally contracted; sometimes one is dilated, the other contracted: stomach irritable. After a time the patient can be more readily roused to consciousness, but immediately relapses into stupor.

The early treatment must be expectant, keeping the patient warm, but not giving stimulants except in case of urgent need from extreme or long-continued prostration; the bladder should be attended to, if necessary. Rigor often precedes reaction; the pulse becomes irritable under disturbance and rises; the skin becomes hot. Perfect quiet should then be enjoined, and a cold lotion applied to the shaven scalp; a purge should be administered, and, if necessary, some leeches should be applied to the temples, and a blister to the nape of the neck. General bloodletting is scarcely ever needed.

Compression of the brain may result from the skull being driven in, or from blood being extravasated on the surface or into the substance of the brain, or into the cavity of the arachnoid, or between the dura mater and bone. In depression, the apoplectic condition exists from the first: where extravasation is the cause, the symptoms may supervene after the lapse of an interval from the receipt of the injury. The indications of compression are those of apoplexy: profound stupor, slow and labouring pulse, slow and stertorous breathing; muscles flaccid, bladder inactive, involuntary discharge of fæces; pupils dilated and fixed. In this condition the patient remains, if unrelieved, until he dies from exhaustion, or perhaps suddenly from further effusion of blood, as the heart regains some power. Symptoms of a less defined or more mixed kind may exist, where the base of the skull is fractured, or the substance of the brain torn. Bleeding or serous oozing from the ears is suggestive of fractured base, though not a conclusive sign. Convulsion or jactitation are often present in torn brain; in such cases, if inflammation supervene, great suffering and violent delirium may follow, if stupor be not profound. Extensive fracture with depression, and extensive laceration and even loss of substance of one hemisphere, may occur, without symptoms of compression, if there be space for the brain to protrude. From this condition recovery is possible; but the patients usually die from secondary effusion into the substance of the brain, or from inflammatory softening extending to the neighbouring cerebral structure.

Treatment.—In depression of a defined portion of skull, with profound apoplexy, elevate or trephine at once. In extensive depression with extrusion of brain, but little good can be done, unless the depressed fragment can be raised with the elevator. In limited depression, where symptoms of compressed brain are absent, no interference is called for or justifiable; but such a case requires careful and constant watching. In doubtful cases, where there is no scalp wound, hasty exploration by incision is to be deprecated. In secondary symptoms of compression, which may arise from extravasated blood or accumulation of pus, the trephine may be required, and is often used advantageously when proper discretion is exercised. But this operation should never be resorted to unless clearly indicated; for it is, in itself, a serious evil, entailing probable sloughing of the dura mater at the circumference of the aperture, and consequent hernia of the brain. Should such protrusion occur, a carefully adjusted pad over the opening, the effect of which must be watched, is the best treatment.

In applying the trephine, the object may be to elevate a depressed fragment of bone, or to remove an overhanging angle, so as to apply the elevator to the depressed piece. In either case much caution must be exercised in cutting through the bone; and it should always be borne in mind that the smaller the chasm made, the less mischief will have been inflicted. A small saw will in some cases supersede the use of the trephine.

The Spinal Cord, *injuries of.* (For fracture, see "Injuries of Bone.")—*Concussion* of the spinal cord may result from a blow, or from a fall on the sacrum. The symptoms of paraplegia which follow may be long persistent if the blow have been severe. The prognosis in such cases should be cautious. Little can be done, but symptoms must be met as they arise. *Compression* may result from extravasated blood, which may occur primarily or secondarily; death may thus rapidly supervene, if an artery have been torn. Fracture with depression is characterised by paraplegia, more or less complete, below the seat of injury; retention of urine, priapism, involuntary discharge of fæces. The cord itself being crushed, the urgency and extent of the symptoms vary according to the height of the injury, and the same cause determines, in great measure, the issue of the case. The intellect is clear, and the general condition of the patient is often illusory. Death is the consequence of inflammatory softening extending upwards, until the respiratory centre is reached and asphyxia ensues. But when the injury is low down the patient has a better chance of recovery, or may ultimately die exhausted. When the respiratory centre in the neck is crushed, death is instantaneous.

Treatment.—By rest on an elastic mattress; regular attention to the bladder, for the urine becomes ammoniacal; regulation of diet and bowels: and precautions should be taken against bed-sores. Operations for raising depressed bone have been proved to be unavailing; the mischief done at the time of the injury is irremediable by such means, and the body of the vertebra is generally involved in the displacement.

SECTION V.

INJURIES AND DISEASES OF REGIONS.

Injuries and Diseases of the Face and Organs of Sense.

FACE.—Lacerated or incised wounds of the face generally heal kindly; and contusions, though followed by much ecchymosis, rarely entail more serious consequences. Wounded arteries may require to be tied; and division of the facial nerve is followed by paralysis of the corresponding side of the face, which is, however, usually only temporary, unless there be loss of substance. Division of the parotid duct is very likely to be followed by fistula, which may also be the consequence of ulceration. If such fistulous opening be small, a touch with a point of caustic or actual cautery will suffice often to close it: if large, a plastic operation or paring of the edges may be required, care being taken at the same time to secure the communication of the duct with the mouth; if this be closed, an artificial opening must first be established by the introduction of a small seton. If a salivary calculus form in the duct, it should be removed from within the mouth. The parotid gland is the subject of inflammation (cynanche parotidea); probably this is chiefly, if not wholly, confined to its fibrous envelope. Neuralgia of the face has been treated by division of the offending nerve, but not with sufficient success to encourage the repetition of the operation, except in a few cases where the mischief may be reasonably referred to the sensient extremities of the nerve only.

MOUTH.—*Aphthous ulcers* of the mouth are usually dependent on disorder of stomach: touching them with a point of nitrate of silver hastens their healing. Deeper ulcers of the tongue and lips may require nitric acid.

Cancrum oris is phagedænic ulceration of the lips, cheek or gums, attended with excessive secretion of saliva. It usually attacks children between teething time and about eight years old. The ulceration generally commences in the gums, which have a spongy, livid appearance; the fangs of the teeth and alveoli are exposed, and exfoliation of even large fragments of bone, with the teeth, occasionally occurs. The mucous surface of the lips and cheeks is often extensively ulcerated; even to perforation, in rarer instances, of the latter. Medicinal treatment should include careful attention to the bowels and secretions generally. The mineral acids, with bark, are useful; and any detergent gargle may be employed. But unquestionably the most valuable remedy, in almost all cases, is the chlorate of potash, which may be given internally in doses of from five to eight grains, with or without the addition of a few minims of dilute hydrochloric acid, and bark: the best wash also is composed of the same salt, in the proportion of ten or twenty grains to the ounce of water, with which the affected part should be frequently bathed. A single application of strong nitric acid may be needed in some cases, but this is rare. Carious teeth should be removed, as well as any loose fragments of bone.

Epulis is a term applied to tumours of the gums, varying much in size and external characters. They usually spring from the fleshy or bony socket of a tooth, are more common in the lower than the upper jaw, and are not malignant in character, though they often attain a large size. These tumours grow slowly, are almost painless, and generally uniform on the surface and fibroid in texture. Their removal is generally facilitated by the extraction of a neighbouring tooth or teeth; and if removed entire they are not recurrent.

If firmly adherent to or growing from bone, it may be requisite to remove more or less of the jaw to eradicate these tumours. The characteristics of true cancer are readily distinguishable, as contrasted with the above.

Dilated salivary ducts, and other fluid tumours of the mouth and lips, are most readily cured by free incision and the subsequent application of caustic—nitrate of silver or potassa fusa—to the secreting surface.

Warty excrescence on the margin of either lip may be destroyed by strong caustic, but generally their doubtful or truly malignant character renders removal with the knife safer. In such case, the incisions on either side should be made to meet at an acute angle, so as to avoid subsequent deformity, when the edges of the wound are approximated. The removal of an entire lip may necessitate a plastic operation for its restoration; but the risk of contracting the opening of the mouth must be borne in mind. Such contraction is sometimes the consequence of cicatrisation after ulceration: it may be remedied by excising a portion of the cheek on either side, exclusive of the mucous membrane, which is then to be divided horizontally in the centre, and fixed to either border of the cutaneous margin: this is a very satisfactory proceeding, if carefully conducted. To form a new lower lip, the skin covering the chin must be borrowed from either side, and raised in the form of two flaps, which are left connected at their outer extremities, and fixed with pins in the centre. The space thus denuded of skin is left to granulate.

The antrum may be the seat of inflammation, excited by carious teeth or exposure to cold, or both combined. Suppuration may be thus established, and the patient suffers much from the confinement of matter, which does not readily escape through the small nasal opening. The sinus must therefore be perforated; and this may be effected either from its lower wall, after removing the offending tooth or stump, generally the second molar; or through the outer wall, by raising a portion of the mucous membrane reflected from the cheek, when the teeth are perfectly sound. The cavity should be repeatedly washed out, and the artificial opening maintained for a time, and a zinc lotion injected. The antrum may be the seat of scrofulous deposit, and its walls become thinned by expansion. The same effect may result from the slow growth of a fibroid tumour, which sometimes attains great magnitude; this form may be safely removed, and with it, if necessary, a portion of the upper jaw or the whole, as the case may be. To attempt the same operation in medullary cancer of this cavity is not only useless, but fraught with immediate danger to the patient, on account of the great vascularity of the parts, and the difficulty of controlling the hæmorrhage.

In relaxed and permanently elongated *uvula*, it may be desirable to remove the redundant portion. If so, this is readily accomplished by seizing the uvula with forceps, and snipping off its point with a pair of scissors. Small perforations in the soft *palate* may be closed by the application—repeated if necessary—of a heated wire to the circumference, or by paring the edges and bringing them together with suture. Cleft palate requires a more complicated operation. Chronic enlargement of the *tonsils* may be relieved by operation; but this should not be undertaken indiscriminately and unadvisedly: the proper test is, interference with respiration and articulation. The guillotine is a simple, safe, and efficient instrument for this purpose: after cicatrizing, the gland tissue still further shrinks. Abscess of the tonsil should not be opened too early; it is dangerous to plunge a knife in deeply and at random; and moreover, such opening will close again if dense tissue have to be perforated before pus is reached.

TONGUE.—Children are not often tongue-tied, though mothers think they are; if an infant can suck freely it is undesirable to cut the frænum, but if this little operation be necessary it should be done with blunt-pointed scissors, directed downwards towards the floor of the mouth, and the section should be limited. The tongue may be the seat of inflammation from various causes, such as the agency of mercury or mechanical injury, or it may occur without apparent cause. If accompanied by œdema, respiration may be interfered with: blood must then be taken from the organ by leeches, punctures, or incision. Ulcers of various character attack the tongue; simple aphtha, indicative of stomach derangement, and from the mechanical irritation due to decayed or broken teeth. Sometimes the tongue is fissured, and this is a more troublesome condition to deal with. Attention to the general health may be aided by the local application of nitrate of silver or nitric acid. Excavated ulcers, with hardened circumference and warty growths, may be somctimes removed in this way, or with a knife; but the true cancerous character is developed in others, which resists all treatment, and is only amenable to the questionable operation of excision; the statistics of this operation, except in the early stage of the disease, are not encouraging. The ligature is, in most cases, safer than the knife. The tongue is occasionally the seat of nævus, which may be destroyed, if superficial, with nitric acid; but, if deep, should be tied. Encysted and fatty tumours are sometimes (not often) met with beneath the tongue, and admit of removal. Ranula is a fluctuating tumour caused by obstruction and consequent distension of the sublingual duct; it should be freely incised, and caustic should be applied to the dried secreting surface. In the rare affection of chronic enlargement or hypertrophy of the tongue, if compression do not suffice, excision of the redundant portion must be practised, so that the protruding organ may be returned within the mouth.

NOSE.—Laceration of the skin or cartilages of the nose generally heals kindly, if carefully treated by replacing the partially severed portions. If there be loss of structure from contusion, sloughing or other cause, a plastic operation may relieve the deformity, as when an ala is lost. Other deformities, resulting from fracture and depression of the nasal bones, and obstruction of the nostrils, may be remedied by similar surgical interference.

In *epistaxis* it is necessary to investigate the cause of persistent bleeding before adopting surgical interference. But if the ordinary remedies fail of affording relief, it may become necessary to arrest the hæmorrhage by plugging the nostril from which it proceeds. For this purpose a wax bougie (if a specially contrived instrument be not at hand) must be armed with a stout ligature, and carried along the floor of the nostril until it makes its appearance beyond the soft palate. The ligature is to be seized with a pair of forceps and brought forwards, the bougie being at the same time removed. An oiled pledget of lint (preferable to sponge) is then to be attached to the extremity of the ligature pendent from the mouth, and to be drawn into the posterior nares by pulling the end which hangs from the nostril until the compress is firmly fixed. It should not be left too long, as it may produce irritation, and even suppuration. If requisite the nostril should also be plugged in front.

Lupus is an eroding ulcer which frequently destroys the entire nose and spreads to the cheeks and lip. It commences usually as a tubercle or warty growth, which then ulcerates beneath the concretion formed by the discharge. It spreads with varying rapidity, and is, in some instances, much less controllable than in others. The general treatment consists in administering alterative and tonic medicines, and a generous diet. Locally, if the sore be foul, its surface should be destroyed with nitric acid or chloride of zinc, and subsequently dressed with soothing applications, and the edges of the ulcer should be supported. A lotion of two grains of nitrate of silver in an ounce of lime-water agrees well with these sores.

Ozœna is a term applied to a fœtid suppurative discharge from one or both nostrils, which is frequently dependent on the presence of dead bone, but not necessarily so. Ulceration of the mucous membrane may account for this condition. It is often a very intractable disease. The general health must be attended to, for the subjects of this complaint are often scrofulous. The nose must be frequently washed out with warm water to prevent accumulation of inspissated secretion, and a weak solution of alum or sulphate of zinc or iodine may be injected. Inhalation of diluted mercurial or chlorine vapour, by the affected nostril, may be useful.

Syphilitic rupia may attack the nose, and, by ulceration, destroy a considerable part of it. Exfoliation of the bones also occurs in this disease, or as a consequence of excessive mercurialization. The treatment must be that for secondary syphilis.

Polypus.—The soft mucous polypus of the nose is a serious mechanical inconvenience, but otherwise innocuous. These growths, which rarely occur singly, spring from the mucous membrane covering the turbinated and spongy bones of one or both nostrils, which are thereby more or less obstructed, often entirely so; and when they attain a large size, great disfigurement is the result, from the bulging of the nostril. These hypertrophic productions are invested with mucous membrane, and are pedunculated, and soft and yielding in their texture, containing but little solid matter. The discharge of mucus from the nose is increased, and the patient experiences great discomfort in breathing or speaking. Occasionally these polypi hang back over the soft palate, in which case a ligature may be required for their removal; but generally they are readily taken away by seizing the growth as near to its attachment as possible, and twisting it off with a suitable pair of forceps; a repetition of the operation is often needed. The consequent bleeding will soon cease; and the patient should be directed to facilitate the operation by forcibly blowing the nose. Cancer may attack the nose, but admits of no cure by operation or otherwise.

Lipoma is cutaneous hypertrophy of the nose, and sometimes attains a large size. The redundant growth may be removed by excision, care being taken to control the bleeding.

Foreign bodies sometimes find their way into the nostrils, especially in children; and require surgical assistance for their removal. For this purpose an expanding speculum should be introduced to ascertain the position of the offending body, which then may be hooked out with a small scoop, or an eyed-probe bent at the extremity.

Partial loss of the nose, as of one ala, may be remedied by transplanting a flap from the cheek; or, when any portion of the cartilage is left, by subcutaneous separation and shifting of the neighbouring skin to the chasm it is intended to fill. A new septum may be made by borrowing it from the centre of the upper lip, and, without twisting it, attaching it to the tip of the nose. Where the entire nose is lost, it may be replaced by borrowing the frontal integument, if healthy. After preparing the circumference of the nasal aperture by dissecting out a sufficiently wide and deep strip of skin, a heart-shaped flap is marked out and carefully detached from the pericranium of the forehead: the peduncle of this must be left tolerably broad and as thick as possible; and is to be separated a little lower on one side than the other, to allow more readily of its being twisted. When bleeding has ceased, the flap is to be attached in its new position with pins or interrupted suture. Subsequent operation allows of the twisted peduncle being rendered less unsightly. It is well to mark the line of incision by previously fitting and adapting a model of leather on the forehead. The gap left must be drawn together as well as may be.

EAR.—Foreign bodies in the ear cause great inconvenience and frequently suffering, when they are deeply lodged against the membrane of the tympanum. If syringing fail of washing them out, a bent probe or small scoop is the best instrument to use, as for the nose. The probe should be bent at an obtuse angle at its eyed extremity, and close to the end. Peas or beans swell, and, in consequence, become more firmly impacted.

Abscess of the meatus or of the tympanum is attended with much suffering, which can be only mitigated by fomentation and anodynes; the escape of pus affords relief. In some instances discharge from the ear becomes chronic, and requires mild astringent injections for its relief. In others, again, purulent discharge is associated with deep-seated disease in the temporal bone, which may, by contiguity, involve the brain and prove fatal. Fungous granulations from the ear are troublesome to deal with: caustic, solid or in solution, may be employed. Polypi from the meatus must be removed with forceps. Accumulation of cerumen is often a cause of temporary deafness, and is to be relieved by free and repeated syringing with warm soap and water. The introduction of cotton often adds to this obstruction. Chronie thickening of the meatus and membrana tympani, and obstruction of the Eustachian tube from inflammation or hypertrophied tonsils, are among the causes of deafness, and are in some instances remediable: thus, the membrane of the drum has been perforated, and the Eustachian tube opened by the use of a catheter, or by injection of air or fluid.

The external ear is sometimes the seat of injury by laceration or otherwise; if torn down, it must be carefully replaced. The concha is occasionally the seat of an intractable form of pulsating nævus.

EYE.—Under the head of *Appendages of the*

Eye, are included the lachrymal apparatus and the eyelids.

Epiphora, or watering of the eye, may arise from excessive secretion, from altered position or obstruction of the orifices of the puncta, or from obstruction in their course, or in the duct. The punctum probe must be cautiously used to relieve constriction of the canals: when there has been inflammation and consequent obstruction of the duct, mucus or pus will accumulate in the sac. If this be not pressed out from time to time, its presence will produce ulceration, and consequent *fistula* lachrymalis. This condition may be relieved by astringent lotions and counter-irritation, but most likely will entail a permanent fistulous opening, which may require the introduction of a style, to guide the tears to the nasal cavity. If possible this alternative should be avoided, and may so be in most cases by diligent attention and continual emptying of the distended sac by pressure. Occasionally earthy concretions in the sac require removal.

In spasmodic *Entropion*, the cause, usually ophthalmia, must be dealt with: where this inversion of either eyelid is permanent, the only remedy is excision of a small fold of the palpebral integument. Chronic *Ectropion* may be relieved in many instances by carefully planned plastic operations. Where eyelashes irritate the surface of the globe, they must be carefully extracted.

Hordeolum, or stye, is abscess on the margin of the tarsus: it must be treated by fomentations, and be punctured when ripe. *Tinea* and *Lippitudo* are terms applied to different conditions or stages of inflammation of the tarsal border, accompanied by ulceration at the roots of the eyelashes. Crusts form, and the bulbs of the lashes are destroyed. Cleanliness, astringent lotions, and the diluted citrine ointment constitute the local treatment.

Various *tumours* form in the eyelids; such as cysts between the skin and tarsal cartilage: to be treated by incision through the thinned cartilage, and irritation, with a probe, of the interior of the sac. Small solid tumours in the same position may require removal from within. *Warts* may be snipped off, or destroyed with caustic. Nævi involving the eyelids require much care and judgment in treating. Nitric acid, or nitrate of silver should be employed: the former in surface nævus; the latter, fused and introduced on a probe, in cellular nævus. (See Vascular system—"Nævus.") *Cancer* may involve and destroy the eyelids and contiguous textures.

Wounds of the eyelids generally heal kindly, if the severed parts are carefully adjusted with fine sutures. *Ecchymosis* occurs readily in the loose tissue of the palpebræ, for which a poultice, mixed with an infusion of black bryony or the scraped root, is an efficient remedy.

Emphysema may occur as a consequence of communication being established by violence between the nose and the areolar tissue of the lids. It is of no importance.

Conjunctiva.—In inflammation of this membrane where it covers the eyeball, the vessels may be seen converging in a tortuous network towards the cornea; and the colour thus imparted is vermilion, by which they may be distinguished from the more uniform pink hue of the sclerotic vessels when injected. Different forms of conjunctival inflammation or *Ophthalmia*, are designated in accordance with their origin or actual condition. Thus, it may arise from injury, and be either transient or lasting: it is then termed *traumatic*. A similar simple condition accompanies cold in the head, and is said to be *catarrhal* ophthalmia. These forms are characterised by increased secretion, a pricking sensation in the eye, and sensitiveness to light; the pain is sometimes acute. The local treatment consists in first soothing the eye by protection from light, and warm fomentations; a small blister behind the ear or to the temple; afterwards an astringent wash. This condition may degenerate or ripen into *purulent* ophthalmia, in which the membrane is folded around the cornea and secretes pus. This destructive form of disease may result from simple inflammation, from injury, or from the contact of poison, especially that of gonorrhœa. In purulent ophthalmia, the lids are red and swollen, so that it is often difficult to obtain a sight of the globe; the raised and deeply injected conjunctiva is folded over the border of the cornea, ulceration or sloughing of which is a probable consequence, and, of course, irretrievable loss of vision. A purge should be followed by occasional alteratives, combined with tonics and stimulants, as the patient may require or can bear them. The local treatment must be cleanliness, fomentations, frequent injection of alum wash—ten grains to the ounce—or of nitrate of silver one third of that strength. The prognosis in these cases is usually unfavorable.

Purulent ophthalmia occurs also in *new-born children*, the result probably, in some cases, of contact with leucorrhœal or gonorrhœal matter. The eye should be frequently washed with a weak solution of alum—two or three grains to the ounce—and the child must be well nourished.

Strumous ophthalmia occurs in scrofulous children, and is very intractable. There is great intolerance of light, copious lachrymation, and the cornea is often involved in the consequences of inflammation. The treatment should be tonic, with occasional alteratives. Locally, a shade, warm fomentation, some simple ointment to the margin of the tarsus, and occasional but careful application of tincture of iodine to the lids, or a blister on the temple.

In *pustular* ophthalmia, these little vascular prominences are found most commonly around the margin of the cornea. They are not really pustules; and require a simple astringent lotion, and tonic treatment, as in the strumous form without pustule.

Granular lids is a term applied to a condition of the conjunctiva in which the papillæ are inflamed and enlarged. Patients, thus affected, complain of the irritation, which is accompanied by lachrymation, and impaired vision from a hazy cornea. Treatment, tonic and alterative; local application of nitrate of silver in the stick; the employment of sulphur in powder or ointment to the interior of the lids.

Pterygium is a reddish hypertrophic growth of the conjunctiva and subjacent areolar tissue, extending slowly from the caruncle outwards, and narrowing as it approaches the cornea. It should be removed by dissecting it up from the sclerotic.

Injuries to the surface of the globe may be mechanical or chemical. Particles of grit or fragments of heated iron may be lodged between the lids and globe, or impacted in the conjunctiva or cornea. In the former case the upper lid should be exposed, by placing a probe upon it and everting it by the lashes; a fine camel-hair pencil may be then used to cleanse the surface. In the latter, when a pointed body is fixed, a lancet or broad needle must be carefully used to dislodge it. Mineral acids, molten metal, or unslaked lime produce serious mischief; but the chemical effect of the first and last is the most destructive: corneal opacity produced thereby is irrecoverable; the surgeon can only soothe. Continued injudicious use of nitrate of silver in solution leaves an indelible stain in the conjunctiva.

Cornea.—Inflammation of the cornea is characterised by vascularity and loss of transparency; there is also a zone of vessels around its margin: it is most common in early lifo; and less permanent, in its effects, on children. Intolerance of light, severe pain, and lachrymation accompany the acuter forms of the attack. The treatment should be tonic, with counter-irritation on the temple or behind the ear, and soothing applications to the eye. If interstitial suppuration and ulceration occur in this texture, permanent opacity follows; the pus may be poured into the anterior chamber, or the cornea may be entirely perforated. This condition is usually accompanied by much pain; the patient must be supported, and the eye soothed and protected. In ulceration of the cornea, the destructive process is marked by a depression without opacity; in reparation the edge of the ulcer becomes opaque, and fine vessels may be seen shooting into it: when healed, the edge of the opaque depression, if any exist, is smooth and rounded off. Escape of the aqueous humour and prolapse of the iris are consequences of perforation of the cornea by ulceration. But little can be done for opacities of the cornea which have existed a long time and are well defined. The treatment of wounds of the cornea must be by rest and soothing remedies. Penetrating wounds may reach the lens and produce opacity; or suppuration in the chambers may ensue. The removal of foreign bodies sticking in the cornea requires great care, that its delicate tissue be not injured. Conical cornea is a change (not inflammatory) affecting usually both eyes. It is irremediable by treatment, but may be palliated, as to its effects, by glasses. *Arcus senilis* is an opaque circle occupying the marginal circumference of the cornea, and appears to be an interstitial fatty degeneration, not affecting the sight.

Sclerotic.—Inflammation of this fibrous coat may be acute or chronic, and may be independent of, or coexist with, inflammation of other textures of the globe. The acute form is characterised by a diffused pink injection of the globe, becoming, however, more intense around the cornea: there is acute pain and great sensitiveness to light. When complicated, as is often the case, with rheumatism, the treatment must be influenced accordingly. Otherwise, alteratives, anodynes internally and locally, and an occasional blister and purge, are the proper remedies. In the chronic form, counter-irritation is more valuable, combined with tonics. *Staphyloma* is thinning and bulging of the sclerotic from pressure; this may be partial or uniform, and the attenuated membrane assumes a leaden hue. This condition is indicative of disease of the globe, and therefore is not suitable for operation, except to remove deformity. The sclerotic may be wounded or ruptured by blow, in which case soothing and rest constitute the only treatment. Sometimes these injuries are complicated with serious or even fatal mischief to the iris or lens.

Iris.—Inflammation of the iris may be acute or chronic; and either form is influenced by syphilis, as well as by gouty and scrofulous temperaments. The remarkable tendency to fibrinous effusion demands special attention, particularly in the treatment of the acute form of the disease. In iritis, the colour of the affected part is changed, and a zone of sclerotic vessels around the margin of the cornea is always present; the iris becomes sluggish in its movements; and speedily patches of fibrin are deposited on its thickened border or its surface: there is increased sensitiveness to light, though not remarkably so. Such inflammation may be the consequence of wound or of cold, or be determined by a specific constitutional cause; it may also be secondary to inflammation of other parts of the eye. Pain is often severe, especially in the rheumatic form of the disease. The syphilitic form is met with in the secondary stage of syphilis; and in it the fibrinous deposit is rapid and abundant; and organization, involving adhesions of the iris to the lens or cornea, speedily ensues if not checked: pain, especially at night, is severe. In all forms of acute iritis, dependence must be placed mainly on the action of mercury, but especially so in syphilis. The mouth must be affected, often rapidly, to save the eye. Combined with this treatment, general support may be afforded, and even tonics are necessary in feeble patients; anodynes must be given at night to allay pain. The local treatment is leeching on the temple and counter-irritation. Belladonna should be applied around, or atropine dropped into, the eye; some surgeons, however, disapprove of this application. Syphilitic iritis occurs occasionally in infants.

The *Choroid* is often inflamed in company with the iris or retina. This, and congestion or extravasation, are conditions assumed from their effects, rather than demonstrated; and the treatment consequently depends mainly on the symptoms.

Retina.—Impaired vision may depend on defective nervous power, and be merely *functional;* or *organic* changes causing amaurosis may be resident in the brain, in the optic nerve, or its membranous expansion. In the treatment of the former, the cause must be removed, and tone supplied by suitable remedies; in the latter neither medical nor surgical assistance can avail much. In medullary cancer of the retina, this membrane first appears injected, and then exhibits a yellow deposit which gradually accumulates and advances, until the lens, and subsequently the cornea, become opaque: the pressure from behind protrudes the sclerotic, and is accompanied by much pain; the anterior wall of the globe then gives way, and permits the escape of the humours, a soft and vascular growth subsequently protruding from the orifice. Profuse discharge and frequent bleeding ultimately destroy the patient. This form of cancer is almost confined to children: the melanotic form occasionally occurs at a later period of life. The eye may be destroyed in a similar way by scrofulous deposit; but this is not fatal to life. Extirpation of the globe for cancer is, at least, as questionable a proceeding as other operations for cancer of an unequivocal character in other organs or parts; it is at best a most uncertain remedy.

The *Vitreous* humour is subject to extravasation of blood from injury, such as a blow. In *Glaucoma*, this humour assumes a yellowish tinge; its substance has been found more consistent than natural, and blood-discs and small clots are found in it. But, as this morbid condition is not limited to the vitreous body, the lens has been found to present the same greenish-yellow tinge, and the vessels of the choroid and retina are congested: the accompanying pain is due to distension.

The *Lens* may be the subject of injury by perforation, and opacity with probable absorption would be the consequence. Spontaneous opacity of the lens, or *cataract*, may occur at any time of life, but is most common at an advanced period. It occurs as a congenital condition, usually in the form of a grayish-white opacity. In the aged, the centre of the lens is usually dried and of an amber hue; but the dulness commences with opaque striæ at its margin, which radiate towards the centre. The tendency of cataract to soften is always exhibited first of all on the surface. The radiating striæ just mentioned prove, by their presence, that the fibres of the lens retain, more or less, their natural condition; their absence, and the substitution of an uniform milky, or irregularly patchy appearance, characterise the softened or fluid condition of the lens. Sometimes the colour of an opaque lens is of a dark brown. The changes in the superficial portion of the lens appear to consist of the deposit of earthy and fatty matter, as the structure of the normal tissue becomes disorganized: the patchy arrangement of these deposits indicates that the capsule is involved in the change; but the latter never becomes absorbed, as the lens itself does under operation; it shrinks and becomes concealed. Spontaneous cataract is very rare in childhood, if it be not congenital.

The different methods of removing an opaque lens are, by depressing it bodily into the vitreous humour; by facilitating its absorption, which is effected by perforating and partially detaching its capsule; or by extraction of the body entire. After absorption of the lens itself, the capsule may require detaching from its connections.

In closure of the pupil, after iritis or in central corneal opacity, it may be requisite to make an *artificial pupil*, by drawing a small portion of the iris through an opening at the margin of the cornea, and snipping it off.

Exophthalmos, or protrusion of the eyeball, may result from the growth of a tumour behind it, or the development of an exostosis of the orbit: in these cases, vision is disturbed by tension of the optic nerve and pressure on the globe. A natural fulness and prominence of the eyeball may exist, without these effects; and it is in such cases that rough handling of the upper lid may force it back beyond the vertical axis of the globe: it must of course be carefully replaced. It has been questioned whether the eyeball can be forced from its socket without destruction of vision; one instance is known to the writer in which such was the case, and it was gently pressed back into its cavity.

Abscess may occur in the orbit, as the sequel of erysipelas (already noticed) or of injury; or, again, of necrosis. The treatment is that of abscess generally. The globe itself may be the seat of abscess, usually occurring in a disorganized eye and from injury. The suffering of the patient demands a sufficiently free and deep incision to evacuate the pus, and allow of the discharge of the humours.

In *Strabismus*, it is usually the inversion of the eye which requires rectifying by division of the internal rectus muscle. For this purpose the eyelids are kept separated, and the eyeball is fixed by seizing a portion of conjunctiva with forceps on the outer side of the cornea. Then a fold of that membrane is similarly taken up midway between the caruncle and cornea, and divided with suitable scissors: a blunt hook is next introduced beneath the muscle, which is drawn forward and divided near to its attachment into the sclerotic. There should be as small a wound and as little disturbance as possible. The eye should be protected for a day or two.

In *removal of the globe*, the conjunctiva should be divided near to the cornea, and the muscles close to their insertion; the optic nerve also should be severed where it is about to perforate the sclerotic. By these precautions the vessels and nerves of the orbit are not interfered with, because the fibrous "tunic of the eyeball" is left intact, between its adhesion to the tarsal cartilages and its attachment around the optic nerve.

DISEASES AND INJURIES OF THE NECK.

Tumours of various kinds occur in the neck, beneath the chin, or in the parotid region. They may be fatty, fibrous, or glandular growths. These must be distinguished from malignant tumours, which it is rarely justifiable to meddle with in these localities. Fibrous or fatty growths may be safely removed, but great care is required in the necessary dissection. The parotid gland is rarely diseased, though morbid growth occasionally occurs in its neighbourhood or even interior, and causes displacement or absorption of its texture. The depth to which such tumours may extend renders their removal hazardous. Cysts are rare.

Abscess of the neck, when deep, often assumes large proportions, and is attended with much suffering and constitutional disturbance, in consequence of the density of the superficial tissues. Such abscesses ought, therefore, to be opened as early as fluctuation is perceived, to prevent the matter from burrowing.

The *thyroid* body is the subject of hypertrophy, termed bronchocele, which is usually solid, and moves, in deglutition, with the larynx. The great vascularity of this texture forbids surgical interference by operation: ligature of the supplying arteries has been proved to be useless. When moderate in size, the influence of iodine, both locally and internally, is often sufficient to arrest the growth, and even reduce considerably the size, of the morbidly enlarged mass. No suffering attends this growth, unless the mechanical inconvenience interfere with respiration. It is common in certain districts, and is sometimes associated with cretinism. Cysts in the thyroid are not infrequent. If punctured, the fluid again accumulates: suppuration may be induced by a seton or the introduction of a piece of lint: sometimes these cysts suppurate spontaneously. The body of the thyroid is rarely the seat of suppuration.

Aneurism in the neck is rare; but the carotid artery may require a ligature for aneurism by anastomosis of the orbit; and it has also been tied for a similar disease affecting the scalp. This operation has been more often performed for hæmorrhage, in wounds involving the trunk or branches of this vessel. Such injuries may be deep and penetrating, or from incised wounds, as in attempted suicide: in the latter case, the proper course to pursue is to seek for and tie the divided branch or branches, probably the thyroid, lingual or facial. In deep, penetrating wounds high in the neck, accompanied by profuse arterial hæmorrhage, it is safer to tie the carotid trunk lower down, as it is impossible to ascertain whether the blood proceeds from either of the main branches or from the divisions of the external branch. In wound of the trunk, lower down, the seat of injury must be exposed, and a ligature applied above and below it.

Cut-throat, in attempted suicide, may be confined to the superficial textures, in consequence of the incision being made over the cartilages of the larynx. But the air-tube may be laid open at any part of its course through the neck, though the large vessels are rarely implicated. The wound may be above the thyroid cartilage, or between it and the cricoid; rarely lower down; the cartilages are sometimes jagged and partially divided. When the wound is long, the extremities may be held together with suture: but no attempt should be made to close the centre, except by position of the head, for the injury must heal by granulation; and suffocation, from accumulated secretion or clot, may be the consequence of an attempt to keep the wound closed. When the bleeding has ceased, the patient should be placed with the head raised, so as to approximate the chin to the chest; and the front of the neck should be protected with some loose covering, so as to raise the temperature of the air inspired through the artificial opening: for patients in this condition often die of bronchitis. The parts should be frequently cleansed; and if necessary, food must be conveyed to the stomach through a tube. No further dressing is required until the breathing is natural; at a later period, care is essential to procure union between the severed parts.

Œdema of the glottis is usually so insidious and rapid as to afford no opportunity for surgical relief. The treatment would be tracheotomy. Laryngitis, or ulceration of the larynx from syphilis or other causes, also frequently demands this operation; and it is the readiest method of disengaging foreign bodies which may have lodged in the air-tubes. It may likewise be needed for obstructed respiration resulting from scalding or similar injury to the fauces, involving the glottis.

Laryngotomy is performed by opening transversely the crico-thyroid membrane: it is a simple operation, but is rarely to be preferred to tracheotomy, as the latter operation affords more room, and is further removed from probable disease for which it is practised.

In *tracheotomy* the patient may either sit or lie, with the head moderately thrown back. The incision must be accurately in the median line, extending for an inch and a half from the cricoid cartilage downwards. The edges of the sterno-thyroid muscles must be carefully separated, and the isthmus of the thyroid body drawn upwards, if in the way. When the rings of the trachea are exposed, if admissible, time should be allowed for bleeding to cease, before it is opened. It should then be fixed with a small hook, and punctured transversely with the scalpel, a blunt-pointed bistoury being subsequently used to divide two rings from below upwards; or the scalpel may be employed throughout: in which case care is required not to push it abruptly or deeply into the tube. The canula should be immediately introduced on a pilot blunt trochar. It must be fixed in its position, and kept clear by the occasional introduction of a feather.

The presence of a foreign body in the air-passages may be generally ascertained from the history of the case, and the physical signs in auscultation and percussion. The amount of irritation varies as the body changes its position, and a sense of impending suffocation may be succeeded by a comparative calm. With the lapse of time the symptoms become more urgent; or the body may become fixed in one or other bronchus, more often the right. Distressing cough and expectoration ensue, and a fatal result may be anticipated as almost certain, sooner or later. By tracheotomy alone, in many instances, the patient has been enabled to eject the foreign body by the mouth; this operation renders the rima less irritable, and permits respiration more easily when the extraneous body is thrown upon the chink of the glottis. If this fail it must be sought for, and, if possible, extracted with suitable forceps.

The *œsophagus* is sometimes the seat of stricture. This may arise from malignant growth. If simple, and at an early stage, the bougie is employed with advantage. At a later period, little can be done. Masses of solid food may lodge in the pharynx and produce serious, if not fatal result. An emetic, if fluid will pass, or stimulating the fauces, will aid in its rejection. Foreign bodies have sometimes been intentionally lodged in the pharynx, and extracted with difficulty. Fragments of bone or other hard matter may lodge lower down, in the œsophagus, and be displaced by the passage of a bougie or probang. Pins or other small sharp bodies may lodge in the pharynx and be reached with the finger, and removed by it, or with forceps. The only cases in which œsophagotomy would be justifiable, are those in which a foreign body cannot be moved within it, and gives rise to serious disturbance: the prominence of such offending body would then be the guide for the operator.

INJURIES AND DISEASES OF THE VISCERA OF THE CHEST.

Penetrating wounds of the lung, by ball or otherwise, may prove fatal from hæmorrhage or suffocation; or pneumonia may subsequently destroy life: but recovery not unfrequently occurs. Wounds of the heart are generally, but not necessarily, immediately fatal: they have been recovered from. Tapping the chest for distension of the pleura with fluid is sometimes required. In such cases the affected side is more distended and the intercostal spaces bulge. The trochar should be introduced as low as possible, *i. e.*, between the seventh and eighth ribs, and near the angle of the scapula, avoiding the latissimus dorsi muscle. The elevation of the diaphragm on the right side should be remembered. The patient should sit, if possible, and the trochar be passed in close to the lower rib. The fluid should be withdrawn slowly, and precaution adopted to avoid the admission of air. This operation will probably require repetition. The presence of air in the pleura is indicated by increased resonance on percussion, with absence of respiratory murmur. (See also, "Fractures of the Sternum and Ribs.")

INJURIES AND DISEASES OF THE VISCERA OF ABDOMEN.

The abdominal viscera are liable to *injury* from contusions or a fall, as well as from penetrating or incised wounds. Collapse, which is usual in such cases, may be the consequence of simple shock, of hæmorrhage, or of actual lesion, from rupture or other wound of the liver, kidney, spleen, or some portion of the membranous viscera. Under such circumstances the treatment can be only expectant. Restore warmth; avoid stimulants as far as possible; watch for reaction; empty the bladder; and give an anodyne when reaction is coming on. Peritonitis may ensue; and this may result also from wounds which only open the peritoneal cavity. In wound of a membranous viscus, it is best, under ordinary circumstances, to leave nature to her own resources. Certainly the viscera should not be disturbed or drawn out to search for a suspected wound; if such intestinal lesion present itself at a wound in the parietes, it would be expedient to close the opening in the bowel with a fine suture before dressing the external wound.

Abscess in the abdominal parietes should be opened early. Abscess in the liver may point and require opening in the right hypochondrium or epigastrium. In opening a hydatid cyst in the liver, it is well to secure adhesion between the walls of the cyst and the abdominal parietes, if such do not exist. This may be accomplished by producing a slough with caustic potash, subsequently introducing a trochar.

The operation of *tapping*, for ascites, or for ovarian dropsy, is to be performed by making a short incision in the median line, midway between the umbilicus and pubes, down to the linea alba, and then introducing a trochar and canula: the abdomen should be compressed with a jack towel, whilst the fluid is escaping; and afterwards a flannel bandage should be firmly applied. The contents of an ovarian cyst may be albumenoid or even gelatinous in consistence; this cannot be ascertained before operating. Excision of an ovarian cyst has been often successfully performed.

Abscess of the iliac fossa may be acute or chronic; it is more frequent on the right side, and usually caused by hardened fæces in the caput coli, or by some other source of local irritation, exciting inflammation in the cellular tissue beneath the colon. This may open spontaneously into the colon, bladder, vagina, or externally. It is occasionally a sequence of parturition. Treat by fomentation, gentle laxative medicines, and general support; open as soon as the abscess points.

Ulceration of the appendix vermiformis of the cæcum occasionally results from mechanical irritation, as from the intrusion of some irritating matter; and is likely to prove fatal from consequent extravasation of the intestinal contents.

HERNIA.—The term "Hernia" is generally restricted to the abdomen, though applicable to the protrusion of any viscus from its natural cavity. Abdominal hernia may occur either at the natural apertures, or at openings resulting from defective formation or injury: the former class includes inguinal, femoral and umbilical; to which may be added the very rare forms of thyroid, gluteal and phrenic: the latter class comprises direct inguinal, ventral, and, though very rarely, phrenic, perineal and vaginal. The usual varieties of hernia met with are, therefore, oblique inguinal, femoral (or crural), and umbilical.

The ordinary *contents* of a hernial sac are, small intestine, omentum, or both: the stomach, bladder or ovaries have been found in a hernial sac, but very rarely.

A hernia may be either reducible, irreducible, or strangulated. A *reducible* hernia presents itself as a soft and usually oval tumour, increasing in size and tension under exertion, such as coughing, and at the same time conveying an impulse to the hand; but generally disappearing spontaneously when the recumbent posture is assumed. A suitable truss is the proper protection in this form of rupture; and the suitableness of such support depends on the adapted strength of the spring, its length and form, and the size and consistence of the pad.

A hernia may be simply *irreducible*, without strangulation, in consequence of its size, or of adhesions within the sac, or of the presence of thickened omentum. If permanently irreducible, such rupture must be supported by a suspensory bandage or truss, with a concave pad of suitable dimensions. Operation for its relief is very rarely justifiable.

A *strangulated* hernia may be of small or large size, but the symptoms are little influenced by its magnitude. The characteristic signs of strangulation are local and general. The local symptoms are the presence of a tumour, more or less tense and tender, in a position where rupture may occur, with pain extending over the abdomen, and especially in the umbilical or epigastric region. The general symptoms are, obstructed bowels (usually), nausea or sickness; and, in a more advanced stage, stercoraceous vomiting, hiccup, general abdominal tenderness and distension, with a quick, sharp pulse, hot skin, restlessness, and an anxious countenance. Cessation of local tenderness and collapse mark the still later stage of mortification of the contents of the sac. The local signs may resemble abscess, inflamed glands, malignant tumour, or undescended testicle; the general symptoms are likewise indicative of intus-susception, or of mechanical obstruction from internal strangulation, from the presence of malignant tumour, or from impacted fæces. The presence of both local and general symptoms, together with the history, rarely leaves room for doubt.

The *taxis* should be first attempted, by flexing the thigh, and making firm but gentle pressure on the tumour, whilst the forefinger and thumb of the free hand grasp the neck of the sac so as to direct the rupture in its proper course: violence is inadmissible; and the continuance of this manipulation must be determined by circumstances. Gentle, uninterrupted pressure will sometimes empty the intestine, which is indicated by a gurgling sensation; this often precedes the reduction. A lesson may often be learned by directing a patient to attempt the return of an old hernia, when strangulated. Sometimes a rupture may be reduced by elevating a patient's thighs and pelvis, and thus compelling its return by the gravitation and traction of the viscera within the abdomen. If these means fail, warm-bath or chloroform *may* be tried, but they rarely succeed, and have the disadvantage often of inducing sickness, and susceptibility to cold from subsequent exposure. More confidence may be placed in the continuous application of ice to the tumour, which acts as a powerful astringent; but this is not always admissible: a full injection of warm water sometimes accomplishes the desired relief; and the same effect has followed the diligent use of hot fomentations. An operation should not be delayed; it is far better to operate early, where there is doubt, than to subject the patient to the extra risk of delay: ill-success rarely attends the former error, if such it be, but frequently the latter.

Inguinal hernia may be either oblique, direct, or congenital. It is more common than femoral in the male, because the inguinal ring is large, and less protected than in the female. In the oblique form, the rupture descends through the inguinal canal in the course of the cord; in the direct, it bursts directly though the external ring: in congenital, the internal ring remaining open, the intestine is contained in the vaginal tunic of the testicle. In the two former the sac of the rupture is a prolongation of peritoneum: the other coverings vary considerably in thickness and divisibility, according to circumstances; and their anatomical description is therefore not to be followed and relied on in actual practice, though valuable as a guide to the operator.

Oblique inguinal hernia may be limited to the inguinal canal, or may descend into and distend the scrotum in the male, or labium in the female. In the male, the presence of enlarged glands, varicocele, hydrocele, or any tumour of the cord, may be mistaken for inguinal rupture; but the continuity of the neck of the tumour with the abdomen, the impulse on coughing, the retention of the tumour, when returned, by plugging the ring, together with the history, can scarcely leave a doubt, unless in very exceptional and obscure cases. The only satisfactory method of determining the nature of a hernia, whether it be inguinal or femoral, is to distinguish between the fundus and neck of the tumour, and trace the latter to the point where it is lost, whether above or below Poupart's ligament: careful examination rarely fails to lead to a correct discrimination.

Direct inguinal hernia is comparatively rare, and probably the consequence usually of violence. The relation of the neck of the sac to the epigastric vessels in these two forms is important: in the oblique, the vessels are internal; in the direct, external, to the usual seat of stricture. Congenital hernia is usually not characterised by peculiarities of practical importance: its sac is the vaginal tunic of the testicle, the anterior loose portion of which it occupies.

Femoral hernia is more common in the female, because the crural arch is wider and the inguinal ring is smaller. It descends between Gimbernat's ligament, the femoral vein, Poupart's ligament, and the pubis. This rupture may be limited to the crural space below the ligament, and then it is readily distinguishable; if it extend further, it ascends upwards and inwards over Poupart's ligament, occupying the inguinal region: it may then be distinguished from the inguinal form, by the position of the neck or more fixed portion of the tumour.

Umbilical hernia is not infrequent in children, rare in the adult male, but more common in females, especially those who are stout. The rupture protrudes through the umbilical opening, and often attains a great size: under these circumstances the superjacent skin becomes at parts attenuated, and the fat absorbed. Such ruptures usually contain omentum and small intestine, sometimes colon, very rarely stomach. They may be irreducible, and then require careful support. In children this form of rupture may be cured by diligent support with a properly-fitted pad.

Ventral hernia may occur at any part of the abdominal parietes, but most commonly in or near to the linea alba. *Thyroid* or obturator hernia protrudes through the obturator foramen of the pelvis. *Ischiatic* or gluteal hernia escapes by the great ischiatic foramen. *Vaginal* hernia descends between the uterus and bladder or uterus and rectum. In the *Perineal* form the descent is between the bladder and rectum in the male, between the vagina and rectum in the female; but any of these latter forms of rupture are rarely met with in practice. *Phrenic* or diaphragmatic hernia is the result of rupture of the diaphragm permitting some portion of the abdominal contents to intrude into the chest.

Operations for strangulated hernia. Operation for the relief of strangulation should not be delayed, after the means referred to have been fairly tried, without effect: and this remark will be found generally applicable, even when the symptoms are not apparently urgent, or some of them are absent; as where an ordinarily reducible rupture resists the taxis, and the patient is suffering from obstructed bowels and some other local or general symptoms associated with the rupture. It must be, further, remembered, that the lower bowel may be relieved of its contents by injection or even spontaneously, whilst strangulation higher up exists. It is better not to administer chloroform, as it is likely to induce sickness in the susceptible state of the stomach. A simple incision is generally sufficient, and this need not, in most cases, exceed from two to three inches in extent. When a rupture is large, as in the scrotal or umbilical, the incision should be over the neck of the sac. If convenient, the skin may be nipped between the finger and thumb, and perforated with a narrow bistoury. The dissection should be carefully conducted and bleeding arteries tied. The anatomical description of the coverings cannot be relied on, for they may be thickened, thinned, or absorbed, or fat or fluid may be deposited between them. Fat must not be mistaken for omentum. When the sac is reached it should be nipped between the finger and thumb, and if gently rolled, the intestine will probably be felt to slip from the pressure; then a light touch with the knife will open the sac sufficiently to introduce a director, on which it may be farther slit up. But the sac and its contents may be adherent; and fluid is not constant within the former. If the tension do not permit of the manipulation described, a small opening may be cautiously scratched in the sac, and its perforation is generally indicated by the escape of fluid, or at least a moist exudation. As regards operating without opening the sac, it should be the exception to the rule: the most fitting cases for this operation are recent cases of femoral hernia. The increased risk of opening the sac is much magnified; and the advantages of doing so are, that the nature and condition of the contents are ascertained and satisfactorily dealt with: moreover, the inflammatory exudation from the interior finds a ready exit, instead of being retained.

The *condition* of a hernial protrusion varies according to the length of time it has been strangulated, and the degree of constriction to which it has been subjected. Omentum may be congested, inflamed, or gangrenous: intestine may be the same, or may be tympanitic, ulcerated, or thickened. Discoloration of intestine may vary from slight injection to a deep claret hue; and this may degenerate into a livid, leaden or ashy tint, which, together with diminished lustre and temperature, betokens an irrecoverable condition. Either intestine or omentum may be adherent to the sac. Omentum is often found in hernial sacs with intestine; and a not infrequent form of crural hernia is, a small knuckle of the latter concealed behind a fold of the former. Omentum is more often found on the left than on the right side.

It is better not to return a mass of omentum if its condition be at all doubtful: if it do not bleed much, it may be torn or cut away with scissors. To divide a stricture and then encircle a mass of omentum with a ligature is simply to substitute one form of strangulation for another. Omentum often sloughs. If intestine be in an irrecoverable condition, or in an ulcerated or mortified state, it must be left undisturbed after the stricture is divided: otherwise, it should be gently returned into the abdomen, first pressing its contents inwards if it be distended. If adherent *feebly* by the deposit of recent lymph, such adhesions may be very cautiously separated; but if they are at all firm such interference is unjustifiable: adherent omentum may be treated with less delicacy; but even in this case it is better to leave undisturbed firm and extensive adhesions. Mortified intestine may be recovered from, with artificial anus; and in some rare cases this may ultimately close.

Seat of stricture.—In oblique inguinal hernia the most frequent seat of stricture is the neck of the sac itself; yet it may be at the external ring. The latter, or the rent fibres of the conjoined tendons is the seat of stricture in direct hernia. In dividing the stricture, the edge of the knife should be directed upwards, with a slight inclination inwards, *i. e.* parallel to the course of the epigastric artery. In crural hernia, the strangulating band will be felt running inwards to Gimbernat's ligament, beneath the upper border of the falciform opening in the fascia lata: it should be divided forwards and inwards. In umbilical hernia, it is better to divide the stricture downwards, to avoid interfering with the round ligament. The extent to which a stricture is divided should always be limited to the necessities of the case.

After-treatment.—After an operation, the upper part of the wound should be brought together with a suture, sufficient space being left below for the free escape of discharge. The outlet by which the rupture escaped should then be supported with a pad of lint and a bandage. The knees should be flexed and supported beneath by a pillow. The diet should at first be light and unstimulating, unless the patient be very low; and all aperient medicine should be withheld, as a rule, for at least thirty-six or forty-eight hours. If the bowels do not then act, a simple enema may be administered; or, if requisite, and if there be tympanitis, a warm aperient draught may subsequently be given. Diarrhœa may follow an operation, especially if aperients have been previously administered, and this will require control: if expected, an opiate should immediately follow the operation. In case of peritonitis, especially if general, the belly should be freely fomented, and small repeated doses of blue pill, guarded by opium, should be given, the patient being at the same time supported. Pain and tenderness in tympanitis should not be mistaken for inflammation: there is always more or less tenderness at and around the wound.

Complications which occasionally occur with strangulated hernia are, abscess, hydrocele, or diseased testicle. The discovery of either of these should not arrest an operation, if the symptoms of strangulation are well marked. In obscure and doubtful cases, the wisest course is to perform an exploratory operation: it is better to operate unnecessarily, than to risk allowing a patient to perish from want of an operation.

Internal strangulation may occur from twisting of some portion of the intestine, or from a coil passing through an abnormal opening in the mesentery or omentum, or under a band of adhesion between neighbouring parts of the peritoneum. The same symptoms may be the consequence of intus-susception, or of mechanical obstruction from hardened fæces or other concretions, or of a tumour pressing on the bowel. The question of gastrotomy may then be raised; and if decided on, should be performed by section of the linea alba below the umbilicus. If the obstruction be below the commencement of the colon, an artificial anus may be established by opening the ascending or descending colon, as the symptoms may indicate, in either loin. This may be accomplished, according to Amussat's plan, by a transverse incision of three inches long, midway between the last rib and crest of the ilium, and extending from the longitudinal muscles outwards. This incision will divide the internal oblique and transversalis muscles, and a portion of the external oblique and quadratus lumborum. Before the exposed intestine is opened, it must be secured by passing a ligature through it; and subsequently, by fixing its margins to the external wound. A longitudinal incision is preferred by some.

INJURIES AND DISEASES OF THE VISCERA OF THE PELVIS, AND OF THE URINARY AND GENITAL ORGANS.

The RECTUM may suffer injury from within or from without. Fragments of undigested matter, as bone, or foreign bodies accidentally swallowed, may lodge in the rectum and lacerate the bowel. When felt, such objects should be carefully removed with the finger, or with the aid of forceps. Foreign bodies have been occasionally introduced into the rectum. The bowel may be wounded in lithotomy; or it may be lacerated by the incautious use of a clyster pipe, or from constipation and the effort to expel hardened fæces, or during parturition. A catheter has been driven into the rectum. In falls, pointed bodies may penetrate the rectum; or its orifice may be torn by a chamber utensil giving way beneath the sitter. In all such cases the treatment must be determined by the nature of the injury. Fæces are sometimes impacted in a large, hard, globular mass in the lower part of the bowel, occasioning obstinate constipation: such condition should be relieved by breaking up the mass with the handle of a spoon or some such instrument, and the subsequent injection of warm water: this may require frequent repetition. An enlarged uterus, or a tumour growing from it, or a large, hard prostate has been mistaken for a tumour of the bowel itself.

Prolapsus of the rectum may require operation. This condition may result from irritation or from relaxation. It occurs from straining, in stone in the bladder, and in habitual constipation: it may also be the concomitant of habitual diarrhœa, or of piles, or condylomatous growths and redundant skin. When irritation is the exciting cause it should be removed if possible. In constipation, or in an atonic condition, the bowels should be kept gently relaxed, and the general health attended to. The removal of hæmorrhoids or redundant integument will frequently effect a cure; or the partial destruction, by nitric acid, of the relaxed mucous membrane. If necessary, a portion, or even the entire circumference (in segments) of the prolapsed bowel may be removed by ligature. In strangulated prolapse, it may be requisite to puncture the congested bowel at several points, to relieve the tension consequent on congestion.

Hæmorrhoids, or piles, are a varicose distension of the veins at the lower part of the rectum. They may be permanently internal or external; or internal piles may be occasionally extruded beyond the sphincter. When internal they cause tenesmus, and occasionally, sometimes habitually, bleed. External or extruded internal piles are liable to attacks of strangulation and inflammation, being girt by the sphincter. The most common cause of piles is habitual constipation, causing mechanical obstruction to the return of the blood: but they may result from irritation caused by habitual relaxation of the bowels: in the latter cases, especially, abundant mucus is secreted; and prolapse after stool is common. Much relief may be given by hygienic treatment; and in constipation, by gentle laxative medicines and alteratives where the liver is sluggish, which is often the case. The habit of relieving the bowels at night is desirable, as the recumbent posture is soon afterwards assumed. Cold or astringent injections may be used in internal piles; and preparations of pepper, including cubebs, are useful: copaiba may afford relief. If the piles or bowel descend, they should be returned by gentle pressure. When hæmorrhoids are inflamed or strangulated, leeches may be applied; but if the tension be great, it is preferable to puncture the swelling freely with a lancet. As a rule it is unsafe to cut away internal piles, for it is difficult to control the hæmorrhage: if pedunculated, they may be brought down and tied, the ligature being cut off close and the tumour returned: or, if more convenient, from size and form, strong nitric acid may be applied. In large piles, which habitually descend or are always external, the ligature is the safest remedy; and if effectually applied, it is certain and not very painful. Two or three ligatures should be employed, where the mass is large; and a dose of opium given afterwards. An operation should not be performed, when the parts are inflamed. The bowels having been previously evacuated, the patient should be directed to strain in order to bring the mass fully into view, and a strong needle, doubly armed with a stout ligature, should be carried through the base of the swelling, and then tied firmly on either side. In case of hæmorrhage from the interior of the rectum, a sponge tent, or ice, or a membranous tube introduced and subsequently distended with cold water, may be employed: or the actual cautery to a cut surface within reach may be essential to save life.

Abscess, and *fistula* as its sequence, may be spontaneous, *i. e.*, dependent on the general health, as in liver or lung disease, or on functional disturbance; or it may be dependent on local irritation and consequent inflammation: foreign bodies, which have perforated the bowel, have been occasionally found in abscesses. The formation of abscess in the recto-ischial fossa is generally accompanied by much pain, and the pus, when it is deep, usually finds its way slowly to the surface: the abscess may burst into the rectum; at other times it opens into the bowel and externally. Such abscess should be lanced as soon as fluctuation is perceptible, to curtail suffering and prevent burrowing. It is better to delay the division of a fistula until the cavity has contracted. The operation of dividing the sphincter may be effected with a blunt bistoury and the finger in the bowel, when there is a communication with the latter: otherwise a hollowed bougie of wood should be introduced into the rectum, and a director with open end be fixed against it; along this a pointed bistoury may be passed, and made to perforate the bowel, fixing itself in the bougie; both can then be withdrawn together. The best position is with the patient leaning over the end of a bed or chair. If the fistula be very deep, it is not requisite nor desirable to divide it to the bottom; but the sphincter must be cut through. Oiled lint should be kept in the wound for a few days. In lung disease, fistula should not, as a rule, be meddled with.

Stricture affects the rectum, as it does the urethra; but is more rare than is usually considered, and generally within reach of the finger. Much mischief is often done by maltreatment in supposed stricture. Displaced or diseased uterus, enlarged prostate, a tumour pressing on the bowel, may be mistaken for stricture. True stricture is usually annular, and produced by plastic deposit in the submucous areolar tissue. The causes are irritation, drastic purgatives, &c.; or contraction may be the consequence of cicatrization of an ulcer. The treatment is by cautious dilatation with a bougie, gradually increasing the size; the bowels should be kept relieved. In complete obstruction high up, it may be requisite to give relief by making an artificial anus.

Cancer of the rectum is a painful and incurable disease. It commences usually in the submucous areolar tissue; and, as it advances, is attended by difficult defecation and discharge of bloody mucus. When the finger is introduced, it meets with an irregular indurated growth, which more or less fills the cavity of the bowels, and is painfully sensitive to the touch and readily bleeds. The treatment can be only palliative; by gentle laxatives, opiates and suppositories.

Prurigo is characterised by distressing itching around the anus, often leading to excoriation, and occurring more commonly in elderly persons. Frequent cold ablution, and zinc ointment or powder, and gentle laxatives will afford relief: but astringent lotions may be needed; or the ordinary yellow wash, which, with a dilute nitrate of mercury ointment, is the most efficacious remedy in obstinate cases.

Mucous tubercles around the anus, and warty growths, are of a syphilitic origin, and sometimes very extensive. Strong nitric acid or some other strong caustic will destroy them, if combined with suitable constitutional treatment. Calomel in powder, or savine, are often equally effectual and less irritating.

Fissure and *Ulcer* of the rectum are usually near to the anus, and more frequent at the back of the bowel than at any other part. The symptoms are acute suffering during defecation; rigidity of the sphincter;

the motions streaked with pus or blood. The great pain complained of suggests the idea of malignant disease, or inflammation of the prostate or uterus, for which it has been mistaken. The ulcer may be readily seen or even felt; and the fissure, with its usually indurated edges, still more easily. Laxative medicines and caustic may be tried, but are rarely successful; the only certain cure is by operation. For this purpose the finger should be introduced into the rectum, and a blunt-pointed, narrow, straight bistoury is to be passed along and between it and the back of the bowel; the edge, being then turned backwards, is to be withdrawn along the fissure, fairly dividing it and the margin of the muscle at the back of the gut. No dressing is needed.

Malformations. (See section on Operations.)

The KIDNEY may be injured by a blow or contusion. Such injury, if slight, may be followed only by bloody urine for a few hours; or this symptom may endure longer and be more severe. In the latter case, cupping, with or without abstraction of blood, will give relief; in the former, a mild aperient and anodyne, with perfect rest, will suffice. If requisite, some astringent, such as the sesquichloride of iron, may be subsequently given. If the kidney bo ruptured, as from crushing injury, a fatal issue may be anticipated.

The *diseases* of this organ belong principally to the physician; but those associated with calculus require notice. The presence of a stone in the kidney may, by obstructing the outlet of urine, produce distension and absorption of the secreting part of the organ, which is thus converted into a membranous sac, the other kidney being usually hypertrophied. A simpler consequence of renal calculus is hæmorrhage, blood being mixed with the urine. Or, though rarely, abscess may result from the same source of irritation, and this may point in the loins, where it should be opened as any other abscess, when near the surface. Such abscess may discharge its contents into the colon or burst into the peritoneal cavity with speedily fatal issue; but these cases are very rare.

The URETERS may be distended, sometimes to an enormous degree, by obstruction. The passage of a renal calculus to the bladder often occasions very severe pain, referred to the loins and affecting sympathetically the thigh and testicle. Hot fomentation and opiates will give some relief.

The BLADDER.—The position, connections and texture of the bladder allow of considerable distension; and such distension, the consequence of obstruction or negligence, may lead to paralysis or atrophy of the muscular coat. An opposite condition of irritability will engender hypertrophy of the muscular coat. The bladder is liable to rupture from violence. This may occur from overdistension, excessive pressure, or from a heavy fall, though these cases are rare: it is more often the consequence of fracture of the pelvis, or of some penetrating wound. Fatal collapse or peritonitis terminate life. It is recorded that gunshot wounds of this organ have been recovered from. Perforation and other injuries of the bladder, in lithotomy, are usually fatal. Foreign bodies are sometimes introduced into the bladder and left there; and fragments of bougie or catheter have been broken into this viscus. An effort should always be made to remove such foreign bodies with a double-bladed spring sound; and some interesting cases of success are recorded: otherwise the lateral operation must be resorted to. Foreign bodies are much more easily removed from the female than the male bladder.

Diseases.—Irritability of the bladder may be simply sympathetic with primary disease of the kidneys. Nervousness, and the habit of frequent micturition may render the bladder irritable, or the same effect may be the consequence of an acrid condition of the urine, or of morbid sensitiveness of the mucous membrane. The treatment must be adapted to the particular case, by the exhibition of tonics, anodynes, or alkaline medicines, separately or in combination. *Paralysis* of the bladder rarely exists as a simple disease in the male; but inability to micturate is common in hysterical women, and is increased by indulgence in the use of the catheter. Steel medicines, and a blister on the sacrum will often relieve it. A paralytic condition of the bladder accompanies disease or injury of the spinal cord, and requires the regular use of the catheter.

Incontinence of urine may result from injury to the urethra, as in dilating the female passage for the removal of calculus, and sometimes occurs after lithotomy. It is also a consequence of over-distension of the bladder, the water dribbling away, as in paralysis; or of obstruction from a large prostate or stricture. It may be hysterical and spasmodic. Incontinence is frequent in children, especially during sleep, and becomes a habit which is difficult to cure. In weakly children tonics may be of service; but moral treatment will do more than physic: if the waking habit be cured, the period, which is usually regular, when the bladder empties itself during sleep, should be watched and anticipated by taking the child up or changing his position. Small doses of cantharides may be tried in obstinate cases.

Inflammation of the bladder may be either acute or chronic. The former is rare, and probably never occurs as a primary affection without the existence of some local source of irritation. It occasionally accompanies or is the sequel of gonorrhœa, and is characterised by severe pain and extreme sensitiveness of the organ, together with constitutional disturbance, requiring antiphlogistic treatment, with anodynes and alkaline medicines.

Chronic inflammation may result from various causes, the most common being disease of the urethra, especially its prostatic portion, or the presence of stone; but it is occasionally present without apparent cause. The kidneys may be primarily or secondarily affected. Ropy mucus or pus, in considerable quantity, is discharged with the urine in the more severe forms of this disease. It may terminate fatally by ulceration or sloughing of the mucous membrane of the bladder, or by disorganization of the kidney.

The treatment is by removing the cause, if evident and practicable. Otherwise by anodynes, alkaline or mineral acid medicines, according to circumstances. Fomentations, and leeches if necessary, to the abdomen. Decoction of pareira brava, with henbane and liquor potassa sometimes affords relief; or an injection of warm water alone, or a decoction of poppy heads, in small quantity. Specific medicines which act on the urethra are also serviceable in the milder forms of the disease.

Hæmorrhage may take place into the bladder, by which the organ is distended with blood. The catheter must be used, and warm water should be injected if clots be present.

Cancer occasionally attacks the bladder. The early stages of this disease are obscure; hæmorrhage almost constantly attends the later stage, and the suffering is very severe, attended by difficult micturition. The treatment can be only palliative.

THE PROSTATE GLAND is subject to inflammation and its consequences, to enlargement and to scirrhus. It is occasionally, perhaps not infrequently, lacerated or perforated by violent or injudicious use of the catheter.

Inflammation may be acute, as from extension in gonorrhœa; or it may be spontaneous. It is characterised by deep-seated pain, irritability of bladder with frequent desire to pass water, and difficulty in doing so; fulness and tenderness of the gland when felt from the rectum. The perinæum should be leeched and fomented, and a purgative administered; an anodyne at night: it is desirable, often necessary, to draw off the water with an elastic catheter. Severe rigor may usher in suppuration, and the pus from such abscess may find its way to the surface or into the urethra or rectum: such cases are often tedious and complicated, from the access of urine to the parts involved. If accessible, pus should be evacuated early.

Temporary enlargement of the prostate may result from inflammation.

Permanent enlargement of the prostate is rare before middle life, but common after this period. In some instances it appears like simple hypertrophy, but in the majority of cases there is also hardening. The size varies considerably, and may be ascertained by examination per anum. The progress of the change is slow, and is marked by difficulty in emptying the urethra and bladder; increased frequency in micturition, with some straining: when the hypertrophy is advanced, the bladder is never emptied, although the patient fancies it is. Too long retention of the water, a fit of drinking, or any special irritation, may entirely incapacitate the patient from evacuating the bladder; and when the distension is excessive, the urine may begin to dribble away. Under these circumstances the coats of the bladder may slough; but this is a rare occurrence. The treatment consists in introducing a large and long catheter of metal or gum; an elastic instrument without a stilet is preferable, but cannot always be made to enter the bladder: the finger in the rectum will aid in directing the point of the instrument. This operation must be repeated until the bladder has recovered its tone. Attempts to pass a short catheter not infrequently terminate in perforation of the gland and profuse hæmorrhage.

Scirrhus of the prostate occasionally occurs, and is characterised by induration and much suffering, in addition to the ordinary symptoms of enlargement.

STONE IN THE BLADDER is far more common in the male than in the female. It may result in either sex from the introduction of a foreign body, around which an incrustation takes place. The nucleus is frequently, perhaps usually, a renal calculus, which has descended to the bladder. A stone usually lies loose in the bladder, but is sometimes encysted, *i. e.* contained in a sacculus of the mucous and muscular coats. Stones vary in size generally according to their age or duration; there may be but one, which is usual, or there may be many. A large and brittle stone may be broken up in the bladder without operation; this is of very rare occurrence: or two or more stones may be joined together in their growth, which is less uncommon. The nucleus of most calculi is either lithic acid or oxalate of lime, more often the former. Some calculi are formed by the deposit of laminæ concentrically arranged; but this is not the case in others; the lithic acid is a good exemplification of the former arrangement, the triple phosphate of the latter. Some calculi, on section, present variations on alternations in their laminated crystalline deposits, in consequence of change in health, locality, diet, or medicine.

The most common stones are the *lithic acid*, of a light-brown colour, smooth and laminated in texture; *oxalate of lime*, called mulberry from its form, which is very dark and hard, and tuberculated or even spiked on the surface; *triple phosphate*, which consists chiefly of the ammonio-phosphate of magnesia; it has a crystalline but otherwise not uneven surface, and is usually light in colour, friable, and not laminated; occasionally it is hard: this stone is very liable to reproduction, and even rapidly so. *Phosphate of lime* is rarely found pure, but is not infrequently combined with the last: it is then, in appearance and consistence, not unlike chalk, and from its property of melting when subjected to a strong heat, it has been called the fusible calculus. *Nitrate of ammonia* is met with chiefly in children. The *cystic oxide* stone is very rare, and so are *lithate of soda* and *carbonate of lime*. Lithic acid calculi often have mixed with them some oxalate of lime or the phosphates; and are calculated to constitute nearly one third of all stones, and to form the nucleus of two thirds. Phosphatic stones are probably next in order of frequency, and the mulberry and mixed or alternating calculi are nearly equally numerous.

The predisposing *causes* of calculus are both intrinsic and external. Mal-assimilation of food from disordered digestion or unwholesome diet, suppressed excretion from insufficient exercise, enlarged prostate acting mechanically in detaining a small calculus, may be reckoned among the former; whilst certain localities seem, from some ill-explained cause, to favour the formation of stone; and, as already remarked, the introduction of a foreign body into the bladder induces the same results even in healthy urine. Disease of the bladder or kidneys may act as a predisposing cause, or be the consequence, of calculus. No age is exempt from stone, although it is certainly less frequent in middle life than in children or elderly persons. The irritation caused by the long-continued presence of a stone in the bladder may lead to ulceration of the prostate, or of the bladder itself, and the rare occurrence of rapidly fatal extravasation of urine or sloughing abscess; or inflammation may extend along the ureters to the kidneys.

The *symptoms* of stone in the bladder vary much in intensity, but little in character: and the degree of suffering depends far more on the sensibility, either natural or from inflammation, of the bladder, than on the size or surface of the stone. Indeed, in many instances, where inflammation is not present, a smooth stone excites more pain than a rough one, possibly because the mucous membrane may have become thickened or otherwise altered by the attrition of a rough stone, or more abundant mucus may be secreted. *Cæteris paribus*, large stones usually cause more pain than small, but not always so. The symptoms are, frequent and urgent desire to make water, with inability to retrain the impulse; the act is accompanied by straining, and succeeded by increased pain from the contact of the bladder with the stone: sudden arrest in the stream as it flows, from the obstruction caused by the stone: pain referred to the hypogastrium, but especially to the extremity of the urethra and glans penis; children seek to relieve this by pinching and pulling the prepuce: suffering is aggravated by any jarring movement: the water contains more or less mucus, and sometimes pus or blood. In children, prolapse of the rectum is often the result of straining. These symptoms are not, however, exclusively peculiar to stone in the bladder; they are suggestive but not conclusive. They may indicate disease of the kidney, inflammation of the bladder, especially its neck; worms or intestinal irritation from other causes: the latter are frequent in children. Therefore, no opinion should be given until the sound has detected the stone.

For this purpose a solid iron instrument is to be preferred, of sufficient length, small in size, with a short curve and bulbous extremity. It may require to be passed far into the bladder, or to be turned from side to side, or suddenly withdrawn towards the neck of the bladder; or it may be requisite to inject the bladder with water or change the position of the patient. The stone must be *struck;* any other sensation is deceptive, such as drawing the point of the sound over a fold of the bladder. Sounding may be often repeated without a stone being detected, though there be one; therefore negative evidence is not to be trusted at once as conclusive. Analysis of the urine should not be neglected. A stone may sometimes be felt through the rectum in children; and the application of a stethoscope over the pubes will aid the ear.

Small calculi often escape spontaneously from the bladder with the stream of urine. Sometimes they lodge and require extraction with suitable forceps; or, if they remain firmly impacted, with sufficient space for the water to pass, they may require to be cut out. Again, small stones may be removed from the bladder with Weiss's forceps.

Although medicines and medicated injections have been recommended and employed as solvents of stone, the cases in which they have been serviceable are, for the most part, questionable, or at least rare; and therefore the only alternatives which remain are, either to crush the stone or remove it by cutting.

Lithotrity is not applicable to all cases. In recent formations, where the stone is not very large nor the bladder irritable or inflamed, this operation has the best prospect of success. The small size of the urethra in children, and the rare fatality of lithotomy in childhood, render the latter operation preferable at an early age. The mechanical obstacles, occasioned by an enlarged prostate, are an objection to lithotrity. When crushing is determined on, the bladder should be habituated to distension by injecting warm water, and the urethra should be accustomed to the presence of a large instrument. In seizing the stone tact is required which habit alone can give. Probably the best direction is, to carry the instrument well down to the lower and back part of the bladder; and then, opening the blades, to communicate a vibratory movement to the instrument, by striking the hand which grasps it with the other; the stone will then fall between the blades of the instrument. It is easier both to seize and crush fragments than an entire stone. Some cases may be relieved at one sitting; others require repeated operations.

Lithotomy.—The operation of removing a stone from the bladder by cutting, is performed by making a lateral incision on the left side of the perineum, between the crus penis and bulb, and thus reaching the membranous part of the urethra, which is then perforated; and the left side of the prostate is next divided to an extent sufficient to allow of the introduction of the forefinger: a pair of forceps is then guided through this opening into the bladder, and the stone seized. Various cutting instruments are employed; but a deeply grooved staff of full size, either curved or straight, is essential to guide the operator in entering the urethra and bladder. If the operator take the staff into his own hand when he enters the bladder, it should be either straight or moderately curved ; if he entrust it throughout to an assistant, it should have a large and long curve, and should be held immovable and well hooked up under the pubes. The desiderata in this, the lateral operation, are :— 1. To make an external, free, and well-depending opening. 2. To open the urethra as far back as convenient. 3. To make a definite and sufficient opening in the prostate. 4. To take care that all cellular tissue and fascia intervening between the external wound and the prostatic opening be freely divided. To accomplish these objects, the external incision should commence at the left side of the raphe, about an inch in front of the anus, and be carried downwards and outwards between it and the tuberosity of the ischium. When the staff is depressed by the operator, it is safer to lay aside the scalpel with which the urethra is opened, and to substitute a beaked knife or gorget for incising the prostate. The ordinary risks attending and following this operation are, hæmorrhage; and infiltration of the cellular tissue around the neck of the bladder with urine, leading to abscess or sloughing. The former accident may be the consequence of cutting too high, or of lateralizing the knife too much as it is carried into the bladder; or it may arise from enlargement of the venous plexus around the prostate, as in the aged. The latter sequence may result from too free an incision into the bladder, whereby the limit of the prostate is overstepped, and the loose cellular tissue around it is thus exposed to infiltration.

Urinary calculus in the female may be removed, either by dilating the urethra with a suitable instrument; or, if the stone be too large, by incision. If the latter step be requisite, the urethra should be put on the stretch with a three-pronged dilator; and a straight blunt-pointed bistoury being then introduced into the bladder, a sufficient incision should be made downwards and towards the left side, to admit of the introduction of a pair of forceps: this is a close imitation of the later step of the same operation in the male.

Retention of urine may be the consequence of paralysis of the bladder, of over-distension, of enlarged prostate, of malignant disease, of ruptured urethra, of stone in the urethra, of abscess in the perineum, or of spasmodic or permanent stricture. Reference may be made to each of these headings. *Suppression of urine* is the consequence of organic disease, or of obstruction in the ureters.

PENIS.—The prepuce is sometimes redundant; and if this be associated with congenital phimosis, it is best to circumcise the patient. *Phimosis* from disease generally yields as the producing inflammation subsides. But if, from the presence of an extending chancre on the glans, or of large warts, it be necessary to divide the prepuce, it is preferable to do so by the side of the frænum; a director and bistoury should be used: the inner and outer skin may be afterwards connected by suture, though it is often fruitless to do so. In *paraphimosis*, regulated pressure on the glans, after puncturing it if necessary, will generally accomplish the reduction. After a few days, however, inflammatory adhesions may prevent this result; but the glans does not often suffer seriously from the strangulation: if tight, the constricting band may be divided.

Warty growths, usually of syphilitic origin, sometimes attain a great size; and, if growing from the glans, may perforate the prepuce. When small or flat, such growths may be destroyed by the application of calomel, or savine leaves powdered; or by the application of liquor plumbi, or nitric acid. If very large, it is better to remove them at once with a knife or scissors: they may grow either from the prepuce or glans, and are often very vascular.

Cancer sometimes attacks the penis, eating deeply and often rapidly into its texture. Amputation at an early period, and before the inguinal glands are affected, is the only remedy; and this is often unavailing.

Urethra.—The course of this canal beneath the arch of the pubes renders it liable to laceration in fracture of this bone, and also from falls on the perineum. The usual symptoms are swelling and pain in the perineum; bleeding from the urethra, which is sometimes persistent and difficult to check: blood may be also extravasated into the scrotum; micturition is difficult or impossible, and the effort occasions great suffering. The patient should be forbidden to make any effort to pass water, and an attempt should be made to pass a gum catheter immediately. With careful perseverance this may be generally accomplished: the finger on the perineum or in the rectum will help. If a catheter cannot be got into the bladder, this organ should be punctured through the rectum, and the canula kept in; or when the symptoms indicate that urine has already found its way through the rent, it is better at once to cut into the perineum, and then pass a catheter into the bladder. Under any circumstances, the instrument must be worn for a time. Although the urethra is often lacerated in rough and clumsy efforts to pass the catheter in stricture, extravasation of urine is not a necessary or frequent consequence of these false passages, probably on account of their direction being contrary to the course of the urine. Such injuries, however, sometimes lay the foundation for urinary abscess, in the way to be presently described.

The urethra is sometimes burst by violent efforts to relieve the bladder, in stricture.

Stricture of the urethra may arise from various causes, which may be classed under two heads; mechanical injury and inflammation. Thus, the cause may be contusion or laceration of the passage, or specific inflammation, as in long-continued gonorrhœa, or from the injudicious use of injections. Spasmodic stricture rarely occurs in a healthy urethra; it is generally an aggravating concomitant of permanent stricture. The usual seat of permanent stricture is in the membranous or bulbous portion of the urethra; but it may be farther forward, and even near to the external orifice: sometimes there are two or three strictures coexisting. The proximate cause of the obstruction is either thickening of the mucous membrane, or, more commonly, inflammatory deposit in the submucous areolar tissue: the canal behind is usually dilated. The symptoms are difficulty in micturition, a small, twisted, or divided stream, and obstruction to the ingress of an instrument. The bladder is sometimes irritable and contracted, at others preternaturally dilated.

In ordinary stricture, the regular and patient use of a bougie or metal sound will overcome the difficulty. The instrument should be adapted to the stricture: in some cases more may be accomplished with a small or conical bougie; in others, a short metallic sound carried down to a callous stricture, and kept pressed firmly against it for some minutes, will effect much, apparently by promoting absorption. Sometimes a catgut bougie is used as a guide to pass a catheter over. The conical bougie is useful in dilating a stricture into which it has been passed. Under all circumstances, violence must be avoided. If something more than the above treatment be required, in the majority of cases of indurated stricture, without other mischief, the cautious employment of potassa fusa is preferable to cutting; it is both safe and efficacious, especially where the stricture is irritable.

Effects of stricture.—Complete retention of urine is the consequence either of neglect in the strictured patient to empty the bladder when required, or of spasmodic added to permanent stricture: it often follows excess in drinking. The natural expedient is the introduction of an instrument; but great care should be exercised that the urethra is not lacerated. After a fair trial, if unsuccessful, it is better to place the patient in a warm bath, and give a good dose of opium, combined with a saline purgative. After two or three hours, and when the aperient begins to act, the patient will probably pass water without assistance; or, the spasm having been allayed, an instrument can be passed. The size of the instrument must be determined by the ordinary stream of water: an elastic gum catheter is preferable, where available, to one of silver: if the latter be used, the forefinger of the left hand should guide it along the perineum, and (by being passed into the rectum) until it has reached the prostate. Gentle friction of the perineum will sometimes relieve spasm. The following plan will sometimes succeed. Pass a small bougie down to the stricture; and, whilst holding it there, bid the patient make an effort to pass water, and then suddenly withdraw it. The opium may be thrown into the rectum.

If all expedients fail, the urethra being free from injury or disease except the stricture, it is preferable to puncture the bladder by the rectum. This operation, which is simple and safe, is performed with a curved trochar and canula, which must be guided by the forefinger of the left hand to the centre of the bowel, immediately above the prostate. There the bulging bladder will usually be felt, and the instrument must be pressed gently but firmly into it: the canula is to be fixed in its position with tapes. If it be thought expedient to open the urethra by the perineum—which becomes a necessity if there be extravasated urine or abscess—the patient should be placed as for lithotomy; and a staff or catheter being passed down to and held against the stricture, an incision is made along the raphe, and the staff being exposed, the knife is to be carried beyond it, so as to divide the stricture: as a guide to reach the bladder, a probe or director may be used, along which a silver catheter may be passed. But this is often a tedious and troublesome operation. Tapping the bladder above the pubes is seldom practised, and rarely justifiable.

Perineal abscess is a not infrequent consequence of permanent stricture. This may be circumscribed and limited, or diffused. It generally presents itself in the form of a hard tender swelling in the perineum, usually in the middle, but sometimes laterally. This may subside spontaneously, pus passing by the urethra; but generally it increases in size and becomes more diffused. These abscesses appear to arise from the ingress of a minute quantity of urine into the submucous areolar tissue, through a small ulcerated opening behind a stricture: inflammatory deposit walls in the abscess and prevents extravasation. If left unrelieved, this condition may terminate either by sudden extravasation of urine, or, more commonly, in urinary fistula. The proper treatment is immediate and free incision into the abscess: a catheter may then be passed on into the bladder, or the urine may be left to drain through the perineal opening; the latter is preferable if the urethra be much disorganized and the drainage free: under these circumstances the pressure of a catheter is not only superfluous but mischievously irritating. At a later period, a catheter may be passed from time to time to enlarge the narrowed part of the urethra.

Extravasation of urine is the consequence of the urethra (or an abscess) suddenly giving way behind a stricture. Speedily the areolar texture of the perineum and scrotum perishes; and, as the urine is further diffused by the pressure from behind, gangrene involves the skin of the penis, occasionally the glans and body of the penis—though this is rare—and extends over the groins towards the umbilicus. Immediate, deep, and free incisions, wherever the urine has invaded the textures, afford the only chance for the patient: no catheter is needed; the urine finds a ready exit by the perineal opening. Patients sometimes recover after sloughing of the entire scrotum, skin of the penis, and skin over the lower wall of the abdomen. Beer-grounds poultice, with a stimulating, nutritious diet, constitutes the chief part of the treatment.

Urinary fistulæ may be the consequence of injury of the urethra, of abscess, or of extravasation of urine. The external openings may be many, or there may be only one; and these may be in the perineum, or scrotum, or in the penis anterior to the scrotum. Under any circumstances it is useless to attempt to deal with these fistulæ until the strictured portion of the urethra is dilated or divided. The best course is to treat the stricture in the ordinary way; and, when a catheter can be passed into the bladder, to retain it there, and freely lay open the fistulous canals, if in the scrotum or thickened perineum; subsequently encouraging granulation from the bottom of the wound. Or, if the stricture be impervious, its division may be undertaken when the fistulæ are laid open. In some instances a point of caustic or cautery will suffice to close a small superficial fistula. Where the opening is in front of the scrotum, it is very difficult to heal, and will probably require a plastic operation to close it.* For this reason the urethra should never be opened in this situation, if it can possibly be avoided.

SCROTUM.—The superficial fascia descending from the abdominal parietes includes each testicle in an envelope, and adheres to the rami of the ischium and pubes of either side, thus limiting and determining the direction of extravasated urine. *Wounds* of the delicate skin may be followed by active inflammation. Blows frequently produce extensive *ecchymosis* or extravasation of blood into the loose subcutaneous areolar tissue; the speedy discoloration and diffusion of the swelling distinguish this from hæmatocele; evaporating lotions aid in dispersing it. Inflammatory

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* See case narrated by author, in twenty-eighth volume of 'Med.-Chir. Trans.'

œdema may follow injury or occur spontaneously; rest, warm applications, and a few punctures afford relief. *Elephantiasis*, except to a very limited extent, is rare in this country; but in warm climates the scrotum sometimes attains an enormous size from this hypertrophic condition; excision is then the only remedy. Simple œdema of the scrotum, accompanying general anasarca, may be relieved by occasional punctures. *Prurigo* usually occurs in old people, and is accompanied by distressing itching and irritation, very difficult to relieve: scratching the part excoriates it, and not infrequently lays the foundation for ulceration. The parts should be frequently bathed with warm water; and moistened with lead or yellow wash; flour to the surface allays irritation. Sweeps are subject to *epithelial cancer* of the scrotum, from the irritation, apparently, of the soot: if removed early, it may not recur.

Hydrocele is a collection of serum in the vaginal tunic of the testicle, over the front of which the fluid accumulates. It is known by its pyriform shape and transparency; but it may be opaque if the tunic be thick or the contents mixed with blood: further, it may be complicated with hernia; or the testicle may be in front. In young children it is not very uncommon, and may be treated by repeated puncturing and evaporating lotions. In adults, the radical cure is effected by drawing off the fluid, and injecting one drachm of tincture of iodine in four or six of water, and leaving it in, subsequently poulticing the scrotum. Hydrocele of the cord may occupy the unobliterated tunic above the testicle, or the areolar tissue of the cord; if puncture do not relieve, the swelling must be incised, and the wound should be dressed from the bottom.

Hæmatocele, or bloody extravasation into the tunica vaginalis, is usually the result of injury, such as a blow or a strain. Its history, rapid or sudden formation, and its opacity, distinguish it from hydrocele. If absorption do not take place after rest, support, and evaporating lotions, it may be desirable to draw off the fluid portion of the blood; or even to make a larger opening should inflammation be excited: sometimes the tunic becomes excessively thickened in hæmatocele.

Varicocele is a varicose state of the veins of the spermatic cord; they feel like a bunch of worms beneath the skin. This swelling will disappear in the horizontal posture and under pressure, like hernia; but will reappear on change of posture, though the ring be closed by the fingers. It is more common on the left side than on the right. The scrotum should be supported by an elastic bag-truss, or a radical cure may be attempted, as in other cases of varicosity, by obliteration of the veins. But this is attended with some risk. A metallic spring or leaden clamp will sometimes accomplish the same result more slowly but safely.

TESTICLE.— This organ may be *hypertrophied* from being over-fed with blood; or *atrophied* from pressure, or as a sequence of that *neuralgic* affection which seems closely allied to irritable breast in the female. *Inflammation* may result from injury, or it may be secondary, as in gonorrhœa, or metastatic, as in mumps. An acute attack requires active antiphlogistic treatment and local bloodletting. Induration of the epididymis is a common and persistent consequence; suppuration is more rare. *Tubercle* in the testis is not uncommon, and is often followed by suppuration, terminating in tedious sinuses, or succeeded by fungating granulations. In this condition the testicle is often spoiled and useless; and being merely a source of irritation had better be removed. *Sinuses* may be healed by injection, though rarely: pressure may keep down the fungating granulations; but the most certain method of dealing with them is to shave them off; and then, paring the edges of the opening, to bring the adjoining borders of it together with a pin or suture. *Fibroid* growths in the testicle are rare; but fibro-cystic or fibro-cellular are less uncommon. *Cancer* is seen in all its forms, though the medullary is by far the most frequent.

In the operation of castration, care must be taken to secure the cord, before dividing it, lest it should retract; and the silk guard, with which it is transfixed, should not be removed until the risk of secondary hæmorrhage is passed. This operation may be needed for the above diseases, or for tubercular testicle where the gland structure is destroyed.

Female organs. Breast.—This gland is occasionally the seat of *hypertrophy* from hyperæmia; and also of *atrophy* from various causes. *Irritable breast* is a neuralgic affection, accompanied by unnatural fulness, which may affect some particular part of the gland, suggesting the existence of a tumour. It occurs in young women, and is generally attended with defective menstruation, leucorrhœa, and pain in the back, and probably other hysterical symptoms. It is to be treated chiefly by attention to the general health, and the exhibition of steel and other suitable tonics: fomentation, and the local employment of belladonna may afford relief in this troublesome affection. Tender or *fissured nipples* cause great suffering in nursing. An astringent lotion will harden the tender, excoriated part; and immunity may often be secured by diligent employment of such a remedy for some time before confinement. When unrequired milk accumulates, it should be drawn off; the application of belladonna is said to be efficient in restraining the secretion. Sometimes the milk will accumulate, forming a fluctuating tumour, and excite ulceration for its evacuation, without suppuration; it should be relieved by puncture.

Acute *inflammation* of the breast may be the consequence of a blow, or occur without any apparent cause; but it is most commonly occasioned by retained or obstructed secretion, and usually terminates in abscess.

Pus will sometimes find its way through the nipple, and milk and pus are not infrequently mingled. These abscesses may be superficial, but are oftener deep-seated; and diffused in some instances, so as to occupy a large space before approaching the surface. Warmth and moisture should be diligently employed until fluctuation is distinct; by thus waiting there is less probability of subsequent sinuses forming, which are often very troublesome to heal, and require free incision.

Chronic inflammation, accompanied by induration, and in some instances terminating in suppuration, may occur at any period of life. The similarity of feel and symptoms may sometimes render the diagnosis between this condition and scirrhus perplexing; but the history and development of the disease can rarely leave room for doubt: the treatment should be by general support, local soothing, and, if it can be borne, graduated pressure.

Cysts, with various contents, are met with in the breast; they may contain serum, albumen, fatty matter, or fluid coloured with blood. These may be numerous, small and scattered, or may attain a large size: their texture is fibro-cellular and vascular; and they are usually developed in the gland-tissue, though apparently in some instances they are originally dilated ducts. Fresh cysts, springing from the interior of a parent-cyst, will burst through the containing cyst and ulcerated skin, and present a protruding vascular mass, which then grows apace. These cystic productions are not necessarily malignant, though they are often recurrent and associated with cancer.

Fibrous tumours, as well as *myeloid*, are rare in the breast; and *tubercle* is never found in it.

The *mammary glandular* tumour is an independent growth, though presenting similarity to the structure of the true gland: the morbid deposit is contained in a capsule, and gradually encroaches upon and replaces the absorbed gland. It may commence on the surface or within the body of the true gland, and is often, though not always, rapid in growth. This tumour is movable, firm and elastic, and attended with but little pain; its removal is usually successful, if none of the diseased texture be left.

Though the medullary and colloid forms of *cancer* are occasionally met with in the breast, they are rare compared with the fibroid form. *Scirrhus*, or hard cancer, is frequent in the breast, and almost always commences as an infiltration in the gland tissue itself, which it displaces as it grows. It is usually of slow growth; and rigid, irregular and cartilaginous to the touch: but these characters are less marked when the growth is rapid. The nipple is often retracted, and the pain is of a sharp, lancinating, or plunging character, and not constant. This disease is most frequent at or soon after the middle period of life, and is often hereditary. As it advances the general health becomes more involved; but in many instances these tumours remain comparatively inert for a considerable time. On section of a scirrhous breast, the surface assumes a hollow appearance moistened with exudation, and presents radiating fibrous bands or limbs; and the gland-ducts may be seen traversing the hard surface. Under the microscope, cancer and other cells are found interspersed amid the lobules of the gland. The question of operating must be determined by various circumstances; such as the age and health of the patient, the history of the case, its progress, the condition of the neighbouring lymph-glands, &c.; and especially the presence or absence of disease in other parts. The statistics of this operation are not of a character to justify indiscriminate interference, nor to encourage sanguine hopes of non-recurrence of the disease, except in rare and favorable cases.

The Labia Pudendi are occasionally the seat of hypertrophic enlargement or elephantiasis, similar to that affecting the scrotum, and must be dealt with in the same way, by excision of the redundant portion:

this is rarely needed. If the seat of warty growth, the morbid mass must be destroyed by escharotics, or excised with a knife. Encysted or other tumours of this part must be excised. Extensive ecchymosis of one or both of the labia may result from contusion. Usually this will disperse spontaneously; but, if persistent, a small puncture will allow of the blood being squeezed out; and though some suppuration may follow, the part will heal under soothing applications. Abscess of the labium must be treated as in other parts.

NYMPHÆ AND CLITORIS.—Hypertrophic growth of either of these parts can be remedied by excision: usually the prepuce of the clitoris alone is the seat of the morbid growth.

Contraction of the external opening of the vagina, the consequence of sloughing after protracted labour, is difficult to deal with; gradual dilatation is the best treatment: the knife is rarely available, unless (which is very rare) there be complete occlusion of the vagina.

UTERUS.—Polypus of the os or interior of the uterus must be treated with ligature; the risk of hæmorrhage forbids the use of the knife. A vascular and very sensitive growth sometimes makes its appearance at the orifice of the urethra. Cautious application of nitric acid may destroy it; otherwise it must be excised. It has been proposed to relieve prolapsus of the uterus by excision of a portion of the vagina; this requires great caution; the instruments now adapted to support the womb are generally preferable.

Vesico-vaginal and *recto-vaginal fistulæ* are distressing conditions. If small, the application of a heated wire, at intervals, may suffice to close the aperture. Larger openings must be closed by paring the edges and bringing them together with metallic sutures, as presently to be described. Carcinoma uteri unhappily admits only of palliative treatment. This organ has been partially—it is said entirely—removed; but this proceeding is scarcely admitted now into the category of the justifiable operations of surgery. Large ovarian cysts admit of being tapped in the same manner as that operation is performed for ascites; but sometimes the contents are too thick for removal in that way: this cannot be ascertained beforehand. The radical cure consists in entire removal of the cyst: for this operation none but select cases should be subjected to the great risk attending it.

Ovariotomy.—The patient being recumbent, with the legs depending, or reclining in an easy chair, the linea alba is divided between the umbilicus and pubes, so as to admit the hand of the operator; this opening is subsequently extended upwards and downwards, as occasion may require. The cyst is then opened with a large trochar and canula low down, and is retained at the surface by an assistant armed with a hook for that purpose. The emptying of the sac is favoured by lateral pressure. The cyst is then gradually drawn out of the abdomen, adhesions being carefully divided if necessary, and fine ligatures applied to bleeding vessels, and cut close. A strong double ligature is next to be passed through the pedicle, and tied on either side, prior to severing the cyst from it. The edges of the wound are then to be adjusted with pins, one of which should transfix the pedicle, to keep its cut surface outside the abdominal cavity. An iron clamp is preferred by some operators, for compressing the pedicle.

The *Cæsarean section* may be required for removal of a fœtus, where the outlet of the pelvis is so obstructed by deformity or the presence of a pelvic tumour, as to prevent a natural birth. For this purpose the length of the linea alba is incised, and the anterior wall of the uterus opened cautiously, to a sufficient extent to admit of the removal of its contents. The umbilicus must be avoided by a deviation of the incision to one side. The uterus contracts when it is emptied; and the edges of the wound should be then adjusted with suture.

Perineal rupture may occur in difficult labour, the rectum and vagina being thrown into one outlet. This cannot be dealt with till the patient is in good health: sometimes this condition is accompanied by prolapse of the posterior wall of the vagina or of the uterus. The points of importance to be attended to in this operation are a free but accurate section of the entire edges of the rupture, so as to present a broad surface for adaptation; and the application of metal sutures at a sufficient distance—say half an inch—from the margins, to prevent the risk of their yielding by ulceration at the points transfixed: the movable shot splint, or even a simple twist of the wire, answers the desired purpose of fixing them. The sutures should be left in six, or eight, or ten days, according to circumstances; and two or three must be applied, according to the extent of the fissure. An elastic catheter should be fixed in the bladder; and the bowels must be kept quiet with opium.

In *vesico-vaginal fistula*, the same precautions are to be exercised in the performance of a similar operation. Paring the edges of the fissure in this deeper operation is facilitated by transfixing them successively with a two or three-pronged director, beyond which the knife has to be carried in making the requisite section for paring the edges: by passing the prongs of this director between the tissues, and not through the mucous membrane of the bladder, a larger raw surface is obtained.

Catheterism in the female is to be performed by passing the right hand, with the instrument, beneath the lifted right thigh of the patient; whilst the tip of the forefinger of the left hand rests between the nymphæ, immediately above the depression which marks the position of the urethra. If this precaution be not taken, the catheter may be passed into the vagina, or between the nympha and labium.

SECTION VI.

OPERATIVE SURGERY; INCLUDING OPERATIONS OMITTED IN THE PRECEDING PAGES, AND DEFORMITIES ADMITTING OF SURGICAL RELIEF.

General remarks.—Although the natural qualifications of good sight, a steady hand and self-possession are necessary in an operating surgeon, an accurate acquaintance with anatomy acquired by actual dissection, and familiarity with the use of the knife, derived from the same source and from operating on the dead subject, are imperative. It is when in the presence of a serious and complicated operation, that the book-anatomist or library-surgeon experiences the fatal error he has committed; and is compelled to make his election between assuming a responsibility to which he is utterly unequal, and thereby incurring the fearful risk of destroying his patient; or that of shrinking from the responsibility, and leaving his patient to die for lack of that assistance which he dares not attempt to afford.

Before an operation is undertaken, every step of it should be carefully considered, and every anticipated contingency should be prepared for. All the necessary preparations should be superintended by the operator himself, and his directions should be clearly given to his assistants as to the part each is to take. Having divided his operation, if a complicated one, into its different stages, the operator's attention should be fixed exclusively on that with which he is occupied:

this will prevent confusion and too great eagerness to reach the conclusion : and whilst he appreciates the duty of avoiding unnecessary delay, he must never lose sight of the ultimate welfare of his patient as the paramount obligation under which he should act, and to which no mere personal consideration should blind him.

In using the bistoury or scalpel, it may be held as a pen or as a table-knife, according to the taste or habit of the operator. Incisions through unimportant soft parts should be freely made ; and, as a general rule, where the ultimate object of the operation is deeply placed, the external incision should be long, as the succeeding steps are thus facilitated, and the subsequent discharge finds a more ready exit.

In administering chloroform, the healthy condition of the patient's heart and lungs should be first ascertained, and the vapour should be allowed to mix freely with the air : it should be inhaled slowly and gradually at first, and the quantity supplied should be limited to the object of rendering the patient insensible to suffering. There is probably no better nor safer method of ascertaining this, than by making a compact with the patient that he shall, at request, give some token that he is still conscious. Thus, by directing him to press an assistant's hand, or to raise his own whenever bidden to do so, the operator is enabled to judge of the precise moment when volition, and with it sensibility, ceases. This condition may be prolonged, as consciousness returns, by a few fresh inhalations. In case of accidental suspension of respiration, water should be dashed smartly on the face ; and, if requisite, the tongue must be drawn forwards from the mouth, and artificial respiration practised.

Bleeding arteries, if small, may be twisted ; if larger, the ligatures with which they are tied must be proportioned to their size. Before closing a wound it should be carefully cleansed from all blood and clots ;

and, as a general rule, it is better to leave a wound open and exposed, till serous exudation replaces true bleeding, *i.e.*, by admixture with the oozing which may still continue. Either metallic or silk sutures may be used in bringing the edges of a wound together; and where lengthened support is required the sutures should be inserted at some distance from the margin of the wound; in which case the metallic suture is preferable. The same remark applies to pins, and the twisted suture; the points of such pins should always be cut off, after their insertion. The subsequent dressing of wounds should always be simple and cleanly; beyond this attention the less interference there is the better; a few strips of plaister, an evaporating lotion or a water dressing, are nearly all that is needed: bandages are rarely required except to afford support.

VENESECTION.—In selecting a vein at the bend of the arm for bleeding, it is desirable to avoid the proximity of the brachial artery, which usually lies immediately beneath the median basilic vein. A broad tape being applied firmly a little above the elbow, the vein must be steadied with the thumb of the left hand, whilst the lancet is carried obliquely into it. When a sufficient quantity of blood is obtained, the bandage is removed, and reapplied, with a pledget of lint, over the wound, and tied below the elbow.

TENOTOMY.—This operation is performed subcutaneously. A very narrow knife is used, and this must be passed across the tendon before the edge is turned towards it; and the section is to be made as it is withdrawn, or by a sawing motion until it gives way. The division is facilitated by first putting the tendon on the stretch. A few days should be allowed to elapse before any extending apparatus is applied.

REMOVAL OF TUMOURS.—In excising solid or encysted tumours, it is rarely necessary to remove integument, unless the tumour be of very large size; healthy integument retracts when liberated from abnormal pressure. With the breast the case is different, as there is, so to speak, a normal redundance of integument corresponding to the gland. A sufficiently large knife should be selected where the tumour is large and solid; and the incision should be free, and shaped according to circumstances: a single incision rarely need deviate from a straight line. It is usually better to dissect up both sides of a tumour: some may be readily raised and isolated, as fatty tumours; others, as cysts, require long and often tedious dissection. Unless the bleeding be excessive and the operation protracted, it is unnecessary to suspend its completion to apply a ligature; an assistant's finger will supply the requisite pressure until the operation is finished.

EXCISION OF JOINTS.—Any joint in either limb may be made the subject of excision. Before subjecting a patient to the risk of the operation on one of the large joints, it behoves the surgeon carefully to consider, on the one hand, whether he may not recover without it; and on the other, whether he have a fair prospect of rallying from the effects of it. Limbs are, no doubt, now saved, which formerly would have been sacrificed; but probably also joints are sometimes unnecessarily destroyed or life risked, by want of discrimination in the selection of suitable cases. In excision, it must be remembered that the joint itself and the surrounding soft parts are usually so far modified by disease, as to require special deviations from the described method of operating to meet the requirements of the particular case.

Humerus.—The head of this bone may be removed by a simple perpendicular incision over it; or by raising a flap of the deltoid, which is to be preferred if much room be required. The capsular muscles will require careful division if not already loosened by disease; and the head of the bone, being turned out from its articulating cavity, is to be cut through with a chain or bow saw from within, or with a common saw from without, the vessels and nerves being carefully protected. The glenoid cavity must be also examined, and dealt with according to circumstances. The elbow should be afterwards supported.

Elbow-joint.—A T shaped or crucial incision over the back of the joint is the best way of exposing a diseased elbow. The olecranon is then to be sawn through, and the disarticulation completed by dividing the lateral attachments of the bones, so that the saw may be used in separating their diseased extremities. Care must be taken to secure the ulnar nerve from injury; it must be sought for behind the inner condyle of the humerus: the olecranon should be saved if possible. The arm should be secured in a semiflexed position, the wound being left free for dressing. Passive motion may be begun when the progress of the case is sufficiently advanced; for considerable motion is sometimes restored after this operation.

Excision of the *wrist-joint* is rarely justifiable, on account of the sacrifice of tendons in reaching it, and the consequent uselessness of the hand; but portions of dead bone may be removed, as occasion may require.

Hip-joint.—If an attempt be made to remove the diseased head of the femur, the incision must be determined by its normal or dislocated position: a similar operation will enable the surgeon to remove the necrosed head of the bone, if left in the acetabulum. Rotation of the limb by an assistant will guide the operator to the upper extremity of the femur; the acetabulum must also be examined. There are but few cases suitable for the operation of excision, whilst the head of the femur is in the acetabulum.

Knee-joint.—Excision of this joint has proved very encouraging. A large incision and free opening are required, and a semilunar flap, with its convexity directed downwards, is the best. The horns of this incision should extend well above the condyles of the femur, and sufficiently far back to secure a broad flap: the convexity should cut across the ligament of the patella. This bone being turned up, the lateral and crucial ligaments, if still undestroyed, must be successively divided quite to the back of the joint, the leg being forcibly flexed by an assistant. The diseased surfaces of bone must be sawn through with a bow saw from behind forwards; and the patella is to be treated, if necessary, in the same way. Every particle of accessible disorganized tissue should be dissected away; and the flap afterwards carefully adjusted with metal sutures. The subsequent position of the limb is to be on a long, well-fitting splint, very slightly flexed, with an extending screw for use, as needed. The dressing in this, as indeed in all these cases, should be plain water.

Excision of the *ankle-joint* is a difficult operation, and one it is rarely advisable to undertake. It is preferable to sacrifice the foot in most cases, by removal at the ankle-joint, and resection of the extremities of the tibia and fibula.

The Clavicle may be removed by an incision along its entire length, and division through its centre, so that either extremity may be separately raised and dissected from its attachments. The important subjacent textures must be carefully guarded.

The Scapula may be removed, the arm being retained. For this purpose free incisions are required, to expose the diseased structure; and considerable hæmorrhage must be expected from the division of large arteries.

The Maxillæ.—The upper jaw may be removed in part or entire: when practicable, it is desirable to save its orbitar plate. One long incision must be made from the outer part of the orbit to the angle of the mouth, and a shorter one, joining the first at an angle, must be carried along the zygoma. The flap thus marked out must be raised; and this will be facilitated by division of the lip in the median line. The alar cartilage is then to be separated from its bony attachment. The zygoma, the fronto-malar junction, and the nasal process of the superior maxilla have next each to be divided with bone-forceps; the palatine plate is then similarly treated, to the exclusion of the velum, and of the palate-bone if possible. The bone, with the tumour occupying it, may then be drawn out, and the operation completed. The adjusted flaps are to be supported by wet lint in the cavity thus left.

In excising half of the *lower jaw*, a long incision must be made from the condyle to the angle, and then, along its lower border, to the symphisis of the bone. The flap must be dissected up, and the membrane of the mouth divided. The symphisis has then to be cut through; and the bone, being everted, has to be cautiously cleared of its deep connexions before the condyle is disarticulated. The hæmorrhage attending this operation is often, but not always, abundant. The whole jaw, or a portion only of one side, or the symphisis, may be likewise removed; but by operations modified according to circumstances.

AMPUTATIONS.

General remarks.—In all amputations, the primary object of the surgeon should be to secure a sufficiency of flap or flaps to close the wound: for this purpose a single or double flap, or one made by a circular incision, may be employed according to circumstances. If muscle be included in the flap, there must be security for the skin extending well beyond it; and it is well to remember that, in amputations for recent injuries, the retraction of the skin is much greater than in amputation for long-standing disease. Practically this is the case, though the explanation probably is, that the healthy, well-exercised muscle contracts much more during incision than that which has been long disused; and that, therefore, after division, its subsequent relaxation leaves it, relatively, much longer than the skin. Attention to this hint will obviate much disappointment, especially in flap operations. In amputations of the lower extremity the patient should be recumbent; in those of the upper, a sitting posture, if practicable, is generally more convenient.

Assistants are required for commanding the bleeding, for tying ligatures, and for sponging. Where dependence can be placed on the assistant, the best mode of commanding an arterial trunk is by compression with the thumb or fingers; but in this case great care is required to steady the limb when the bone is sawn through, or all command may be lost over the artery, as at the groin: otherwise a spring clamp, or screw tourniquet with a suitable pad, may be employed. Where it is important to save blood, the limb may be raised for a few moments, to favour the unloading of the vessels, before pressure is applied; and this should immediately precede the incision.

Flaps may be made either by perforating the soft parts and cutting from within outwards, or in the reverse way; in the latter case, as in the circular operation, the skin should be made tense by drawing it from the extremity of the limb. It should be remembered that, in flap operations, especially those made by perforating, vessels are often cut obliquely.

In securing an artery of any size, two pairs of forceps are required; one for seizing the vessel, and the other for clearing away the surrounding textures; and the ligature should be firmly tied high up. A tenaculum is often very useful, in seizing and drawing out smaller arteries, when it is less important to exclude other textures: one end of the ligature should be cut off. Veins should not be tied if it can be avoided; but sometimes it is necessary to secure them.

The knives used should be proportioned in size to the bulk of the part to be removed: in all operations on the hands and feet a long and very narrow bistoury is the most convenient. In dividing a bone the saw should be first drawn from heel to point, and used lightly without pressure, and with a free sweep backwards and forwards; the holding assistant being directed to avoid raising the limb, by which the saw is nipped, or depressing it, by which the bone is splintered. During this part of the operation the soft parts must be carefully protected with the hand or a linen retractor. A stump should not be closed until all bleeding has ceased; and tight bandages must be carefully avoided, if any be employed. A piece of lint dipped in water is all that is needed, over the sutures or strips of adhesive plaister.

Upper extremity.—In removing either of the *phalanges*, a palmar flap is to be preferred, when practicable. The phalanx must be bent, and the knife carried across the joint, which, it must be remembered, is not at the angle formed by the conjunction of the two bones, but anterior to it. When the joint is laid open, each lateral ligament is to be divided; and then the flap is formed, by measurement, from the front.

In removing the *ring* or *middle* finger at the *metacarpo-phalangeal* articulation, the intervening wall, connecting it with its lateral neighbours, is to be divided by incisions which meet at an acute angle opposite the joint: the tendons in front and behind must then be cut through, and the disarticulation completed by dividing the lateral attachments of the bones. If a strong hand be required, the head of the metacarpal bone should be left: but more symmetry is secured by removing it with a small saw or bone forceps. In removing either the *fore* or *little* finger at the same articulation, the flap should be taken from the free border; and caution must be observed in securing a broad piece of skin, by pinching it up before perforating: the flap should be commensurate, or nearly so, with the length of the phalanx.

The *thumb* or little finger may be removed, including the metacarpal bone, by an extension of the last operation; *i. e.*, in either case by carrying the incision down to the carpus; and, after disarticulating and turning out the metacarpal bone, by separating a broad measured flap from it, cutting from above downwards or towards the phalangeal extremity of the member.

Wrist-joint.—The hand may be removed at the wrist-joint by either a circular or double-flap operation; care being taken to secure sufficient integument, which is apt to retract much at this spot, as indeed at any part of the fore-arm. The styloid processes may be left or removed at pleasure. The proximity of the ulnar nerve to the artery should be remembered, in tying the vessels.

Forearm.—Amputation may be performed at any part of the forearm, either by a circular or double flap incision: in the latter case, perforation with a narrow catlin is to be preferred; but much muscle should not be included.

Upper-arm.—Amputation above the elbow is best performed with a circular flap of the skin only: the profundæ arteries will probably require ligatures as well as the brachial. Amputation at the elbow-joint is an unadvisable operation.

Shoulder-joint.—Although circumstances may require a variation in this operation, such as the formation of a double flap, in front and behind, the best method of removing the arm at the shoulder-joint is by making a flap from the deltoid to cover the exposed axilla. On the right side, the point of a long knife is made to perforate the shoulder a little below the acromion process, and at the anterior margin of the deltoid; it is then carried over and round the head of the humerus, and pushed out at the posterior fold of the axilla: by cutting outwards and close to the bone a large flap is formed, including the entire deltoid to its insertion. The capsular muscles being next divided, the arm is carried across the chest to facilitate its disarticulation. When this is accomplished, the knife is carried downwards on the inner side of the bone until the separation is completed. The only variation, when the left arm is the seat of operation, is, that the knife is entered at the posterior wall of the axilla, and brought out at the anterior margin of the deltoid. The subclavian artery must be compressed above the clavicle, with the thumb, or the handle of a large key carefully enveloped in lint; and an assistant should be prepared to seize the artery as soon as it is exposed: if essential, the artery may be secured before division, by arresting the operation at the proper stage: but this is scarcely needed, where assistants are to be depended on.

Lower extremity.—Operations on the *toes* are similar to those already described as applicable to the fingers: and it must be borne in mind that the value of the great toe in the foot is scarcely inferior to that of the thumb in the hand: it should therefore be preserved whenever it is practicable; or as little of it as need be sacrificed. Removal of the entire toe, with the metatarsal bone, must be effected by disarticulating it from the inner cuneiform, and making a long and broad flap from its inner side.

In removing the toes with the *metatarsal* bones, the disarticulation is accomplished from above, and the flap is to be made from the sole of the foot.

In the operation known as *Chopart's*, the calx and astragalus alone are left. In this operation, also, the disarticulation is effected from above, the incision being guided by the navicular bone on the inner side and the cuboid on the outer. The flap is made from the plantar integument.

Ankle-joint.—This very satisfactory operation is thus performed:—The anterior incision should extend in an oval direction from the point of one malleolus to that of the other, securing just sufficient front flap to extend well beyond the base of the tibia: more is undesirable, as the cicatrix must be anterior to the seat of pressure. The lower incision, *i. e.*, the anterior margin of the posterior flap, should be directly beneath the malleoli, and extend transversely across from one to the other; and this incision should be carried freely and at once down to the bone. The subsequent dissection is facilitated by another incision, carried downwards and backwards, and from the *outer* point of union of the two flaps,—that is, towards the tuberosity of the os calcis. The skin and fat should be peeled carefully from the heel-bone, until the great tendon is reached; and this requires both time and caution to accomplish. Then the ankle-joint may be dislocated from the front; and the tendo Achillis is the last part to be divided. The malleoli must be sawn off, and also, if diseased, the articular surface of the tibia. Care should be taken to divide the plantar arteries, if possible, *after* the bifurcation of the posterior tibial. Sloughing of the cellular tissue and of a portion of the posterior flap is not an uncommon occurrence; and therefore the latter should be of ample dimensions. The small angular flap left by the third incision is very likely to slough, but can well be spared. After clearing away diseased tissue, and when the bleeding has ceased, the flaps are to be adjusted with wire sutures.

A *modification* of this operation consists in leaving the tuberosity of the os calcis, by sawing through the bone in its centre, and adapting it to the sawn base of the tibia. This method is less tedious, but the success, as it depends on the union of the two bones, is not so certain as in the operation at the ankle-joint.

Leg.—In amputating below the knee, either a single flap of muscle and skin may be obtained from behind, or a double skin or circular flap operation may be performed. The circular is, on the whole, the best. It is undesirable to leave more of the leg than sufficient to form a rest for a wooden substitute, unless it be intended to adapt an artificial limb of more complex make, unsuitable to a working man. The tibia should be cut through immediately below its tubercle, the sharp point of which may be sawn off obliquely. Amputation at the knee-joint is not to be recommended.

Thigh.—Amputation of the thigh should be performed as low down as convenient. Either the circular skin flap, or double flap with muscle, may be practised; the latter is to be preferred. A long and rather narrow knife is to be used for forming the anterior flap, by cutting from without inwards, and drawing it from heel to point: then, without removing the knife, the point is made to perforate the thigh behind the bone, by carrying it from the terminal extremity of the first incision, till it makes its appearance at the corresponding point on the opposite side: this second section, for the back flap, is made from within outwards: the remaining soft parts are then cleared from the bone before the saw is used. Lateral flaps are sometimes preferred.

Hip-joint.—Disarticulation at the hip-joint may be effected by the same operation as the above, higher up: both incisions should be made from within outwards, *i.e.*, by perforation or transfixion, the point of the knife entering midway between the anterior spine of the ilium and the great trochanter, and making its exit, after crossing in front of the bone, on the pubic side high up. The anterior flap, long and full, being completed, the posterior section is made in like manner, after the capsule, round ligament, and capsular muscles have been divided, and the head of the bone has been disarticulated. The femoral artery must be compressed at the groin.

THE BREAST.—Small and non-malignant tumours of the mamma may be extirpated without meddling with the gland, or removing more than the neighbouring portion to which such tumour may adhere. But in scirrhus it is rarely justifiable to leave any portion of the gland. In removing the whole breast the patient may be sitting or recumbent. A large and long scalpel should be selected, and the incisions should be deep and free. The amount of integument to be sacrificed must be determined by the size of the breast and tumour; and the form of the incisions must depend on these and other accidental circumstances. Where it is practicable, a crescentic piece of skin may be included between two incisions meeting at their extremities; the edges of the wound can thus be afterwards more accurately adapted. The dissection being well carried beneath one side, the mass is turned over and the extirpation completed. Great care should be exercised in leaving no portion of disease behind; and this caution is especially requisite when there are deep adhesions, and the diseased tissue has to be dissected up from the pectoral muscles. If there be indurated glands they must be removed: but an operation would scarcely be undertaken, unless under exceptional circumstances, where such lymphatic contamination was known to exist. When the bleeding vessels are secured, and the hæmorrhage has ceased, the edges are to be kept in contact with sutures and light strips of plaister, the arm being kept by the side.

The Penis.—In cancer of the penis, before the lymphatic glands are involved, this organ may be amputated, care being taken to get well behind the disease. The removal may be accomplished at one sweep of the knife; and, the remnant of the organ being held firmly by an assistant, the dorsal and cavernous arteries are then tied. As the wound heals, care must be taken that the contraction does not close the urethra: on account of this tendency it is desirable not to preserve much skin. The bleeding after this operation is sometimes very troublesome. A catheter is not needed.

LIGATURE OF ARTERIES.

General Remarks.—The instruments required for tying an artery are, a scalpel, with the extremity of the handle sharpened, a director, retractors, a pair of forceps, and an aneurism needle of firm metal, armed with a strong silk ligature of size corresponding to that of the vessel. A needle of the common form is usually the best; and the extremity of the handle may be notched or perforated, to hold and keep the loose portion of the ligature from falling into the wound. The external incision should be free, and longer where the artery is deep: in every respect this is desirable, both as facilitating the operation, and also the after healing of the wound by permitting the ready discharge of pus. In exposing the artery it must be disturbed as little as possible in its cellular bed; and the needle must be passed around it with the same precaution. When the extremity of the needle presents itself on the opposite side of the vessel, the nail will probably suffice to scratch an aperture for its exit: the ligature is then to be seized with forceps and drawn through, whilst the needle itself is withdrawn. The ligature is not to be tightened, till its pressure is proved to be sufficient to arrest bleeding or the admission of blood into an aneurismal tumour: it is then to be tied firmly with a plain double knot; and its ends are left to be guarded with a strip of adhesive plaister, near to the wound when it is dressed. The edges of a long wound may be held together with one or more sutures, space being left for the escape of discharge. The period which elapses before the separation of a ligature—which should be quite spontaneous—varies, according to the size of the vessel and distance from the heart, from a week to a fortnight or three weeks. In ligature of the larger vessels, about the tenth or twelfth day is the most critical period; though hæmorrhage from ulceration and premature separation of the ligature may take place earlier. If retained beyond a reasonable time, the ligature may be put gently on the stretch, and fixed over a little roll of plaister with a strip of the same, so as to raise it perpendicularly; but even this must be done cautiously.

In conducting the dissection for laying bare an artery, muscular tissue should never be divided, if it can be avoided by separating the cellular connections of adjoining muscles: great perplexity is occasioned by want of attention to this precaution.

Radial artery.—Ligature of this or of the ulnar artery is generally required for wound, and the position is therefore determined by the seat of injury. At the wrist and through the greater part of its course, where it is accessible, the radial artery lies between the supinator longus and flexor radialis; here it is to be sought, and will be found beneath the fascia, and overlapped above by the muscles: it is accompanied by two veins, but the nerve leaves the artery at the lower third. The skin should be divided to the extent of two inches.

Ulnar.—This artery is to be sought for beneath the fascia, by separating the flexor ulnaris from the flexor sublimis, under cover of which it lies deeply above; but it is comparatively superficial below, where it is still overlapped by the flexor ulnaris. It is accompanied by two veins, and has the ulnar nerve on its inner side, throughout its course.

Brachial.—At the bend of the elbow the brachial artery lies beneath the aponeurotic expansion from the biceps tendon, having the tendon itself to its outer side and the median nerve on the same plane and to its inner side. This artery may require one or two ligatures here, for wound, or varix dependent on wound. The superficial veins must be guarded from injury. The superficial position of this artery through the arm renders it easy of access at any point higher up: in cutting down on it, the large basilic vein must be avoided; and care must be taken that a nerve is not mistaken for the vessel, and that a high bifurcation do not frustrate the object of the operation.

Axillary.—Ligature of this artery is rarely practised. It may be tied by opening the axilla itself, where it is surrounded by nerves and its large vein is superficial. If an attempt be made to tie the artery higher up, the great pectoral muscle must be divided to a sufficient extent to expose the smaller muscle of the same name, which may be drawn downwards: after the fascia in this position is divided, the artery will be found, having the nerve cords above and the vein below and to its inner side.

Subclavian.—The position selected, when practicable, for tying this artery is in the third division of its course, where it lies external to the scalenus muscle. The difficulty of this operation is greatly enhanced by the elevation of the clavicle, where there is aneurism of the axillary artery high up. The subclavian artery in this position will be found in the angular interval between the first rib and the insertion of the scalenus muscle into it. To seek for the scalenus, and to trace it to its insertion, should therefore be the object of the operator; all other guides are fallacious. The vein which lies in front of the scalenus need not be exposed, nor offer any obstruction to the exposure of the artery: the nerves lie above and behind the latter, and the lowest of these large cords may be, and has been, mistaken and tied for the artery. To obtain ample space for the deep dissection, two incisions should be made, one horizontally above, or, rather, over the clavicle when the skin is drawn down, and about three inches in extent: from the inner extremity of this incision, which should reach to within an inch of the sterno-clavicular joint, another incision should extend vertically upwards; and the flap of skin thus defined can be dissected up: some fibres of the sterno-mastoid may be divided with advantage. After this the knife is but little required, but the cellular connections are to be separated until the scalenus muscle is exposed. When the artery is distinctly felt pulsating, the needle is to be carried round it, by introducing it from before, and directing it backwards and upwards.

Carotid.—The common trunk may be tied low down, or higher up and nearer to its bifurcation. Below, it is more deeply placed, not only under cover of the sterno-mastoid muscle, but also beneath the sterno-hyoid and thyroid. Above the point of divergence of these muscles the artery is comparatively superficial, and may be exposed by an incision extending downwards for two or three inches, from the os hyoides and along the border of the sterno-mastoid muscle: the fascia and platysma being divided, and the edge of the muscle drawn aside, the sheath of the vessels is exposed, with the descendens lingualis lying upon it; the jugular vein is behind and external to the artery, and the pneumogastric nerve lies between them: the aneurism needle should be passed from behind forwards. In tying the artery lower down, an incision of similar length must be made, but reaching to the sternum, along the border of the sterno-mastoid muscle: the sterno-mastoid being drawn outwards, and the sterno-hyoid and thyroid inwards, the artery is exposed, partly overlapped by the jugular vein, and more so on the left side than the right. In these operations, the superficial veins, especially one or two crossing the sheath high up, must be avoided.

In deep, penetrating wounds of the neck high up, attended by arterial hæmorrhage, it is safer to tie the common trunk at once than to search, at great risk and probably in vain, for the bleeding vessel, which may be either the external carotid or its branches, or the internal trunk. The short interval between the origin of the external carotid and the distribution of its branches is a serious, if not insuperable, objection to placing a ligature upon this vessel, except in case of wound. Some of its branches may require ligature under similar circumstances, as in attempted suicide, and in operations on the neck and face.

The *anterior tibial* artery may be tied, as it crosses the tarsus, where it will be found immediately to the outer side of the extensor pollicis tendon: lower down it sinks between the first two metatarsal bones. It is accompanied here, as higher up, by two veins and a nerve, the latter being usually on its outer side. Throughout the leg, the anterior tibial artery lies on the interosseal space, having the tibial muscle to its inner side throughout; on its outer side the long extensor overlaps it in conjunction with the last-named muscle, and here it is most deeply placed: in the middle of the leg the long extensor of the great toe is interposed between the other two muscles, and here the artery is to be sought between the extensor pollicis and tibialis anticus. In the lower third of the leg the extensor of the great toe crosses to the inner side of the artery, which is then found between this muscle and the common extensor. In seeking for the vessel between its muscular coverings, it is requisite to pay particular attention to the caution not to divide the structure, but simply to separate the cellular connections, of the adjoining muscles.

The *posterior tibial* artery occupies a deeper position than the anterior by reason of the extra layer of muscles on the back of the leg; and the attachment of the soleus to the tibia renders it still more difficult of access: it is accompanied by two veins, and a much larger nerve than the anterior tibial, which lies behind and generally to the outer side of the vessels. At the inner ankle the artery is comparatively superficial, and lies between the tendons of the long flexor muscle in front, and the flexor of the great toe, which is at some distance behind it. In this position the artery may be felt pulsating, and may be compressed, or tied, without much difficulty. In the calf the artery may be secured by cutting through the centre of the superficial muscles; but this operation is not admissible, except in a thin limb, for punctured wound. The better method is to separate the inner head of the soleus, on a director, from its attachment to the tibia.

The external incision should be free for this purpose, as the vessel will be found at a considerable depth. No other muscle should be meddled with; but the dense intermuscular fascia which binds down the deep muscles and vessels must be divided freely, in a longitudinal direction, on a director; and the artery will be found immediately beyond the outer or more distant edge of the tibia.

The *popliteal artery* is rarely made the subject of ligature. It occupies a deep position as it traverses the space of that name, after entering its inner side from Hunter's canal. To find it, a long incision through the centre of the ham is required, and after the fascia is divided, the artery is to be sought to the inner side of, and nearer to the joint than, the internal popliteal nerve and the vein.

The *femoral artery* may be tied at any point between Poupart's ligament and the upper part of Hunter's canal: but, unless any special circumstance determine the spot, the lower part of Scarpa's triangle is to be preferred, where the artery is overlapped by the sartorius muscle. The superficial incision should be free and parallel to and *over* the sartorius, to avoid the saphena vein which lies over its inner border: the risk of cutting on the long adductor instead of the sartorius will be thus avoided, and the wound will be directly over the sheath of the vessels. The last-named muscle, being exposed to a sufficient extent, is to be turned aside outwards, and its dense aponeurotic sheath brought into view: this must be carefully slit open, and the vessels will then be seen in their cellular bed. The vein lies to the inner and back part of the artery, and the saphenus nerve to its outer side; another nerve, more superficial, must not be mistaken for that within the sheath. The best direction in which to pass the needle is from without inwards, as its point can thus be inserted between the two vessels; but this is not important. In this operation the limb should be flexed and laid on its outer side.

The *external iliac artery* must be reached by an incision a little above Poupart's ligament, which should commence to the outer side of the external ring, and be carried upwards and outwards for about three inches towards the spine of the ilium. The cord must be cared for, whilst the aponeurosis of the external oblique, as well as the internal oblique and transversalis muscles and fascia, are divided on a director. The peritoneum is then to be carefully separated from its cellular connections, and the aneurism needle introduced around the artery from within outwards, *i. e.* between it and the vein.

Internal or common iliac arteries.—To reach these vessels a longer incision is required, which should extend from the middle of Poupart's ligament, upwards and a little outwards in a curved direction—the convexity of the curve being towards the iliac spine: the remaining steps of the operation are similar to those of the last: the ureter crosses the bifurcation of the common trunk; but it follows the peritoneum, when that membrane is separated and lifted from the vessels.

The *abdominal aorta* may be reached by the same operation, or a modification of it, by which the incision is carried somewhat farther upwards and backwards, on the left side.

MALFORMATIONS ADMITTING OF SURGICAL RELIEF.

HEAD AND NECK.

Hare-lip may be single or double, and accompanied by partial or complete cleft of the palate. An operation may be performed at a very early period if the child cannot suck; but it is better to wait until about the fourth month: if deferred beyond that period or the fifth month, it should not be done until the teething has ceased to be a source of irritation. In single fissure, the cleft is always on one side of the median line. In double fissure, one or both incisor bones frequently project, and require to be depressed by frequent or continuous pressure, or to be excised before operation.

The most important points to be attended to in these operations are, the liberation of the lip, if tied down by the reflected mucous membrane: a sufficiently free incision to secure adaptation of a *broad* surface of the adjoining margins: extension of the incisions well round each angle, so that no notch be left at the border: union of the two incisions at the upper angle, so that no orifice of communication be left between the mouth and nostril: accurate adaptation of the pared edges with pins passed well through the entire substance of the lip, excepting the mucous membrane: security against the risk of subsequent interference by the patient. Where a wide palatal fissure exists, much good may be effected by the infant's nurse frequently pressing together the sides of the face with the fingers and thumb, so as to approximate the borders, before an operation is undertaken.

In single fissure, each angle should be successively perforated with a hook, and thus kept on the stretch, whilst the necessary incisions are made with a thin and narrow blade; the lip being compressed, meanwhile, by an assistant. Two pins should be used; and a single fine suture may be added, if needed, at the margin: a single strip of adhesive plaister should be carried across the lip from cheek to cheek to afford support.

In double fissure, the lateral edges being pared, the central pendant portion may be used, by converting it into a triangular flap to occupy the higher part of the gap, the upper pin being passed through it to fix it in its position. In these operations the little patient must be secured in the lap of an assistant. The pins may be safely removed at the end of forty-eight hours; but support should be continued for a few days, with strips of adhesive plaister carried from cheek to cheek.

Cleft palate.—When the soft palate only is the subject of fissure, it may be united by paring the edges and adapting them. Under any circumstances this is a difficult and precarious operation, and should never be undertaken until the patient is of an age to endure the necessary pain inflicted, and cheerfully to submit to the self-denial afterwards required. Division of the muscles forming the pillars of the fauces, and subsequently of the levator and tensor palati on both sides, facilitates the approximation and adaptation of the pared edges. As perfect rest as possible must be subsequently enjoined. Especial knife, scissors, forceps, and needle are required for this operation. The palatal muscles are divided with a curved knife, immediately internal to the humular process of the pterygoid plate.

Ptosis, or depression of the upper eyelid, may be a natural defect, and seriously impede vision. This may be corrected in a measure by cautious removal of a portion of the redundant integument from the lid, and the subsequent use of sutures. Other defects in the interpalpebral aperture may be rectified by division of contractions, or by excision of integument to change the position of the commissures. These defects are not common.

Strabismus or squinting arises from undue balance of action between the recti muscles. It is the inner one which usually requires division. This is effected by pinching up a fold of conjunctiva, which is to be divided with suitable scissors ; and, a small hook being then introduced, the muscle is caught and brought forward for division.

In *wry neck*, division of the origin of the sterno-mastoid muscle at its origin, in part or entirely, may be occasionally admissible; but the cases in which it is so are few.

TRUNK.

Imperforate anus.—This congenital defect may be merely skin-deep, or comparatively superficial occlusion: in such case, the straining of the infant will indicate the point for a crucial incision, by the prominence of the contents of the bowel. If deeper, the scalpel must be directed by the finger, or a director. In the latter case a bougie must be frequently introduced to keep the opening free. When very deep, the point of the knife must be directed backwards and upwards. Under these circumstances the bowel may terminate in a bulging cul-de-sac; and long-continued attention may be requisite. The sphincter is generally perfect.

Hypospadias is a deficiency of the inferior wall of the urethra, near to its orifice. If trifling, it is comparatively unimportant, and does not require surgical interference: but if the exposure of the mucous surface produce irritation, relief may be afforded by making use of the prepuce, in a plastic operation, for covering the fissure.

Epispadias, or deficiency of the upper wall of the urethra, is rare, and accompanies the more serious arrest of development, in which the abdominal parietes and anterior wall of the bladder are deficient. When the defect is limited to the urethra, the tegumentary edges may be pared and brought together, or a flap may be raised on either side, and the surfaces of the two adapted and kept in position by quill or bead suture, as in closing accidental openings of the passage in front of the scrotum.

In congenital *phimosis*, circumcision is the proper remedy where the prepuce is redundant; but if otherwise, the prepuce must be slit up by the side of the frænum. This operation ought not to be performed in childhood, unless the orifice be so small as to obstruct the free passage of the urine.

If the scrotum be divided, which is very rarely the case, this simple and unimportant defect may be corrected by paring the adjoining edges and adapting them with sutures.

Imperforate vagina may be of a very simple kind, merely consisting of a thin membranous septum at its orifice; this may be split up with a probe in most instances, or a knife may be required. If the *hymen* be imperforate, this defect, being further back, does not attract attention, until accumulation of the catamenial discharge creates discomfort and suffering. A crucial incision at once remedies this malformation, and no after-treatment is required. In abnormal enlargement of the *nymphæ*, their sensitiveness, when thus exposed beyond the labia, may be a source of much discomfort; and removal of the redundant portion is then justified.

EXTREMITIES.

Supplementary or *bifid thumb*, *fingers* or *toes*, require removal. If possible, the joint, which is usually common to both, should not be opened, as the integrity of the spared member would thereby be risked. Other congenital malformations of the humerus and forearm rarely admit of any relief, except by mechanical appliances. The same remark applies to congenital dislocation of the ossa femoris.

In *club-foot* and similar deformities, much may be done by mechanism without operation; but in many cases tenotomy is an essential preliminary to mechanical assistance. The tendo Achillis is the most frequent subject of operation for these defects; and is, fortunately, most amenable under this treatment, uniting more readily than any other tendon. The division of other tendons must be undertaken with a knowledge of the possibility of their not again uniting; but even this sacrifice is required in some cases of deformity.

The operation of tenotomy is performed subcutaneously, a narrow and pointed knife being introduced, and carried past the tendon to be divided: its edge is then directed towards the tendon, which is divided outwards as the knife is withdrawn. During the section, the tendon should be put on the stretch, and the completion of its division is thus readily ascertained. As regards the after-treatment of these cases, it is better to wait for a few days before any extending apparatus is applied: in the interval, the limb should be kept at perfect rest.

The hamstring muscles may occasionally require division in contraction of the knee; but this is usually the consequence of disease. Caution is requisite in this operation to avoid injury to the nerves, especially the external popliteal.

The usual varieties of club-foot are three: *equinus*, in which the patient walks on the toes only; *varus*, in which the foot is inverted and thrown over on its dorsal aspect; *valgus*, in which the foot is everted, so that the patient walks on its inner border.

In pes *equinus*, the deformity may be the consequence of the whole length of the limb being shortened: in such cases an operation for letting down the foot is useless. But where the fault is in the shortening of the muscle, division and subsequent elongation of the tendo Achillis is the remedy.

Talipes *varus* is the most common deformity; and, in extreme cases, is attended with displacement and distortion of the tarsal bones, probably the consequence, though congenital, of irregular muscular action. The bones of the leg rest partly on the shortened os calcis, and the astragalus is consequently pressed forwards: the other tarsal bones are influenced in a minor degree, and the ligaments and fasciæ are either contracted or stretched according to their position. An abnormal bursa is usually developed on the back of the tarsus, on which the foot rests when placed on the ground. As a general rule, it is desirable not to interfere by operation until the child is two or three years old, or even later. In many, if not most cases, division of the tendo Achillis, with subsequent prolonged and continuous use of a suitable apparatus, is all that is needed. This tendon should be divided at its narrowest part, above its insertion. The small wound should be immediately closed with a strip of adhesive plaister. If, in this form of talipes, other tendons are involved, they are the tibialis posticus and flexor pollicis: should these require division behind the tibia, great care must be exercised not to implicate the tibial vessels and nerves: the shortened plantar fascia is more likely to require division; and this may be also done subcutaneously.

In talipes *valgus*, which rarely occurs until the foot has been used for some time, and is often the consequence of relaxed and elongated internal lateral ligament as a primary condition, the long extensor and peronei muscles take advantage of the loss of resistance and aggravate the deformity. If tenotomy be necessary, it is these tendons which require division. The peronei may be readily cut through, where they lie together immediately above the outer malleolus, or lower down; but the former is the preferable position. The extensor tendon should be divided in front of the ankle-joint, just before it breaks up on the tarsus; the most prominent part is the best guide to the operator, who must be careful to keep his narrow knife close to the back of the tendon.

In the very rare form of talipes *calcaneus*, which is exactly the reverse of the pes equinus, and in which the patient walks on the heel, all of the three anterior muscles are most likely to be implicated in determining the deformity.

After any of these operations, the patient may be encouraged to put the foot to the ground with the apparatus on, after it has been worn for a few days; and subsequently, when it is thought prudent to throw aside this mechanical assistance, a properly constructed boot, with a supporting iron, should be supplied.

SECTION VII.

SUGGESTIONS IN EMERGENCIES AND DOUBTFUL CASES.

SHOCK.

Collapse from injury may be the consequence of simple shock to the nervous system, of wound of some important organ, or of hæmorrhage. These various causes may coexist. Many cases occur in which it is not, at first, manifest to which the symptoms are to be assigned. Thus, a patient has been struck or kicked on the abdomen, or he has fallen from a height, or has been run over by a heavy vehicle. No external lesion is apparent: the surgeon ascertains that there are no broken bones, and that there is no external wound of importance. What is to be done? The patient should be moved with great caution, and enveloped in hot blankets, and heat should be applied to the feet. Stimulants should be avoided, if possible, or given very moderately and cautiously. Soon a catheter should be passed, to ascertain that the bladder and urethra are uninjured. Light nutriment and drink may be given in moderation. As reaction comes on, small doses of opium will tranquillise, and will also quiet the peristaltic movement, in case any portion of the intestine be wounded. These cases terminate according to circumstances. Reaction may be very gradual and slow, leaving the surgeon long in doubt as to the issue; and yet the case may terminate favorably, without proof of organic lesion.

He must not conclude, from the presence of abdominal pain and tenderness, that peritonitis from such lesion is imminent: for local and even diffused tenderness over the abdomen may subside, without leaving any trace of mischief. Depletion is rarely admissible in such cases; but warm fomentations afford relief. Reaction may, however, be followed by acute peritonitis; or inflammation may ensue, with scarcely any reaction. In either case, it is probable that some fatal lesion has been inflicted on some one or other of the abdominal viscera. Again, a patient may die speedily, or after the lapse of one or two days, without any effort at reaction. Sickness is a distressing, and, if protracted, an unfavorable, symptom in these injuries: mustard to the epigastrium, and cool acidulated drink may relieve it. Blood in the urine may appear and continue for some days, without other evidence of serious mischief to the kidney. The prognosis in all these cases should be very guarded,—even when the symptoms are favorable: and the strictest rest should be enjoined for some time.

HÆMORRHAGE.

Bleeding from an incised or lacerated wound usually (but with certain exceptions) admits of treatment by position, cold, pressure, or the application of a ligature on the bleeding vessel, if an artery. Under any circumstances the surgeon should thoroughly clear away all clots from a bleeding wound, before he employs any measure to stop the bleeding. In punctured wounds, however, the case is different, as arterial hæmorrhage demands the prompt interference of the surgeon, generally by operation, to arrest it.

Suppose such wound to be in the neck, below the hyoid bone, and attended by copious arterial hæmorrhage. The proper course to pursue would be to extend an incision upwards and downwards from the wound, and to expose the bleeding point of the carotid trunk, and tie it above and below the injury. An assistant should, meanwhile, compress the artery lower down: and the introduction of a probe or director will help to guide the operator to the wound in the vessel.

If the wound be higher up, *i. e.*, under the angle of the jaw, the arterial bleeding may proceed from either internal or external carotid, or from some branches of the latter. The safest practice, in a case of penetrating wound in this position, is to tie the common carotid a little before its bifurcation: the bleeding should be controlled, meanwhile, by pressure, with a compress or the fingers of an assistant, in the wound.

In hæmorrhage from incised wounds of the throat, the open orifice of the bleeding artery must be sought for and tied.

The radial or ulnar artery is not infrequently cut near the wrist, by the hand being thrust through a pane of glass, or by the breaking of a glass bottle in the hand. The bleeding orifice must be sought for, and a ligature placed above and below it, if the vessel is only partially divided; if quite severed, two bleeding orifices must be sought for till found, and tied. The wound may be extended for this purpose, if requisite. There is a nerve in company with the ulnar artery at the wrist, but not with the radial. Care should be taken to include only the artery in the noose. The wound may be subsequently closed.

In lacerated or cut palm, the bleeding is often very troublesome, and difficult to arrest. The wound should be thoroughly cleansed from coagulum, and if a bleeding artery be seen, it may be twisted or tied. Further incisions, however, to search for the vessel would prove abortive, and probably lead to further mischief by opening fresh branches. What, then, should be done? The wound being cleansed and the brachial artery temporarily compressed, a piece of sponge of suitable size must be wrapped in thin muslin or gauze, and pressed firmly into the wound: a bandage is then to be applied over it, around the hand and extending up the arm: the limb should be placed with the hand elevated and resting on a pillow. The advantage of wrapping the sponge in muslin is to prevent the blood from coagulating in the pores of the former, which would involve the forced separation of the clot when the compress is removed: the use of the bandage and position is to moderate the circulation. Should bleeding still persist, after this plan, with the aid of cold and other styptics, has been fairly tried, the proper treatment is to tie the brachial artery in the middle of the upper arm: ligature of the radial or ulnar, or even of both, is likely to prove ineffectual, on account of the free anastomosis between them and the interosseal arteries: for the same reason compression of these vessels near the wrist fails: continuous compression of the brachial artery for any time could not be borne, on account of the proximity of the nerves. (See "Ligature of Brachial.")

Suppose the hæmorrhage to proceed from a penetrating wound on the inner part of the thigh, and that it is arterial in character, and sufficiently abundant to leave no doubt that the femoral artery is wounded. The first step is to direct that pressure be made on the artery as it crosses over the pubes: even an uninitiated assistant may do this with his thumb or a large key wrapped in a piece of linen, if properly instructed. Then cleanse the wound of blood, and pass a director gently as far as it will reach. This should be held firmly by an assistant, as it serves to guide the operator to the bleeding point. A free incision should then be made, in the course of the artery and having the wound for its centre. When the vessel is exposed the perforated part is to be included between two ligatures, with as little disturbance as possible: the edges of the wound are to be approximated, and the ligatures brought outside in the usual way. (See "Ligature of Femoral.") It is very possible, if the external wound have been plugged before the surgeon's arrival, that extravasation of blood may have taken place into the thigh; but this must not deter him from pursuing the same course, turning out the clot as he proceeds. Nor must he be misled by the temporary arrest of bleeding from this cause or from faintness: if the artery is wounded, it must be tied as described.

But this same tense and swollen condition of the thigh may occur, accompanied by faintness, but without external wound. The history of such a case would probably be, that the patient felt something give way in the thigh, and that swelling rapidly ensued. If many hours have elapsed, and the tension is great, the surgeon probably finds the leg already œdematous and deficient in temperature: the tibials pulsate but feebly or not at all. The probability is, that this is a case of ruptured femoral artery; and of diffused false aneurism as the consequence. It is evident that the same course of proceeding as that just described is not strictly applicable here: inasmuch as there is no external wound to guide the operator to the seat of injury. Therefore the surgeon has at once to select between two alternatives; either to tie the artery at the seat of injury, if that can be found, above it if it cannot; or else to employ palliative measures, and wait. A third alternative, of amputating, may present itself at a later period. The palliative means referred to are, compression of the artery at or below the groin; general support of the limb by bandaging, and elevation of the feet. If there is evidence that hæmorrhage is still going on, or the tension of the limb threatens its vitality, palliative measures are out of the question. Unless the condition of the limb is hopeless, and thus demands amputation, ligature of the artery is then the proper course. But the question is, where is it to be applied?

If the swelling is limited, that may serve as a sufficient guide to the operator. But if the extravasated blood is diffused through the thigh, he must make his incision freely over the course of the artery, as in an ordinary operation. He must then clear away the clots, and examine the vessel, which he will probably find he is able to do without much dissection. If he find the seat of laceration, he will place a ligature above and below it: if not, he must apply a single ligature high enough to command the bleeding.

It may be that a penetrating wound involves the anterior or posterior tibial artery. In such case, there can be no hesitation as to the propriety of cutting down upon, and tying the bleeding vessel above and below the seat of injury. This is facilitated by introducing a probe or director to the bottom of the wound, and cutting upon it; a precaution which will be found of assistance, even when the posterior tibial artery is taken up in the way already described (vide *ante*, p. 185). These accidents occur occasionally in reaping or mowing.

Bleeding from a scalp wound is generally controlled by the application of a compress; but a partially divided artery will sometimes give great trouble; in which case, its complete division with a knife, and subsequent compression, is preferable to ligature.

POPLITEAL ANEURISM.

The treatment of popliteal aneurism by pressure requires much care, and unflagging attention; and it is useless to undertake it unless these can be bestowed. The surgeon should always bear in mind that the pressure is designed only to moderate the flow of blood through the artery, and thus permit the accumulation of fibrinous deposit on the interior of the sac, with a view to its ultimate obliteration. The best instrument to use is one which, partly encircling the limb, makes circumscribed pressure, through the medium of an oval pad, on the artery, and possesses a larger pad at its opposite extremity for counter-pressure. The patient should never be left without the superintendence of a competent and well-instructed attendant. The pressure should first be very moderate, and increased only as it can be borne: it may be varied in amount, though it is undesirable to intermit it entirely. The position of the pad should be changed from time to time; but during this moving upwards or downwards, as the case may be, it is desirable to control the circulation at the groin: on reapplication of the pad, its effect should be tested by placing the hand on the sac, whilst the screw is adjusted. The sac itself should be carefully examined day by day, to notice whether there be any tenderness or heat, indicating inflammation. If so, it will be unsafe to continue the pressure, as suppuration and hæmorrhage are likely to occur, and the artery should, therefore, be tied in the usual way. Irritable persons are bad subjects for this method of treatment. Pressure, by forced flexion of the knee, has been advocated.

BURNS AND SCALDS.

Severe burns or scalds require prompt attention and careful treatment. In stripping off the clothes of a burnt patient, great care should be exercised that the skin is not stripped off at the same time: and this is especially necessary in removing a tight garment, such as the stockings, which should be cut in their length instead of being drawn off. An examination must then be instituted over the whole of the burnt surface, to ascertain whether any, and what part, of the cutis has perished. The charred or ashcolour of the destroyed skin, usually with a defined margin, indicates the line of demarcation between the dead and the living skin. In extensive burn, even without destruction of skin, the general condition of the patient demands immediate attention, for death may speedily result from the shock attending even a scald over a large surface. The patient must be treated in the same way as if suffering from collapse from other causes, viz.: by being warmly covered, and having warmth applied to the feet: and, in addition, stimulants are generally requisite to assist in restoring the heart's action: and when warmth is restored, a few drops of laudanum (according to the age of the patient) may be given at intervals, to allay pain and nervous irritation. Milk, beef-tea, jelly, &c., should be administered. The condition of the mucous membranes requires careful watching, as the suspended function of a large surface of skin excites a vicarious effort in them.

As regards the local treatment of a part in which the cutis has perished, there is nothing preferable to a warm poultice, aided, subsequently, by a stimulating lotion, until the slough has separated. Where vesication has occurred, the surface must be protected at once, by rag dipped in oil and lime-water, or by flour dredged over it, or by a thin paste of whiting painted or spread over it, or by cotton wool.

Whenever the burn or scald involves a large surface, the prognosis should be guarded, even though the injury is superficial, and however favorable the early symptoms may be.

THE DIAGNOSIS OF TUMOURS.

In forming an opinion on the nature of a tumour, the surgeon is guided by a variety of circumstances:

yet, even long familiarity with disease, and trained delicacy of touch and discrimination of eye, are not always sufficient to guide the most experienced to a certain diagnosis: therefore, the young practitioner must expect to meet with perplexing and doubtful cases in this branch of surgery. The circumstances referred to are the following:—The hereditary tendencies, and past and present health, of the patient. The history of the disease, as to the tissues primarily attacked or secondarily involved; and as to duration, appearance at different times, varying rapidity of growth, suffering, and any special tendency exhibited during its development. The existing position, mobility, attachments, form, size, consistence, vascularity, and sensibility of the tumour. Its interference with health, and with functions of other parts or organs. Its tendency to induration, softening, inflammation, ulceration, or suppuration. The application of these remarks will be found in the following analysis of the special characteristics of the more common forms of tumour.

Nævus, or vascular tumour, is generally congenital: when accompanied by swelling, constituting it, in fact, a tumour, its primary seat is in the areolar tissue, and the skin is frequently involved secondarily: its growth is generally uniform and unattended by pain. When the skin is not marked by the characteristic scarlet blot, which shows that the disease has extended to it, the subcutaneous nævus is a soft, doughy swelling, often presenting a blue tinge on the surface, generally adherent to the skin, painless, varying in size, according to its duration and other circumstances; and becoming distended when the subject of it cries or strains. These tumours usually exhibit no tendency to become inflamed, except under irritation. They frequently remain stationary for a considerable period, but generally grow uniformly by extension in superficial diameter and thickness. With the exception of the aneurism by anastomosis, these vascular swellings do not pulsate; but they may be partially emptied of their blood by pressure, refilling when the pressure is removed: they bleed freely when punctured or cut; and sometimes under ulceration, resulting from pressure or friction. No part of the surface of the body has immunity from vascular tumours; but they are more frequent on the face, scalp, and back of the trunk, than on the abdomen and extremities.

SIMPLE CYSTS are generally of slow growth; though frequently, after long quiescence, they suddenly begin to expand rapidly. There seems to exist in some individuals a tendency to the production of these cysts, and very often there are several in the same individual. They may occur at any period of life; and present themselves usually either under the form of dilated natural ducts, as in the sebaceous or lactiferous cysts; or of the expansion of the areolar spaces of a tissue, in which fluid accumulates, and thus forms, in time, a circumscribed sac. These cysts are limited to the tissues in which they originate, and encroach, by their expansion, on surrounding textures. In their origin they are generally firmer in texture than when the accumulation of their contents expands and thins their walls. Those which are accessible for operation are found chiefly about the head, neck, and breast; but they likewise occur, in connection with tendons and over parts subjected to pressure; as ganglions and bursæ. Cysts are generally movable as regards their deep connections, though often adherent to the superjacent skin; they vary in form, but single cysts are generally uniform and oval or round in figure, unless modified by the pressure of surrounding textures. Their consistence depends on the character of their contents, which may be solid, thick or thin fluid; and on the density of their walls: they sometimes fluctuate on pressure. They are not very vascular nor endowed with much sensibility. Cysts have a disposition to suppurate, if irritated; and sometimes ulceration of the surface will allow of the escape of their contents, and of a spontaneous but tedious cure.

Sebaceous cysts occur chiefly in the scalp, and sometimes attain a large size. Cysts which are found in the neck, and in the thyroid body in particular, are either single or multilocular, or in clusters, and usually contain serum in a limpid state, or discoloured with blood or other colouring matter.

Cysts of different kinds, and with various contents, are found in the breast; they may contain serum, or milk, or discoloured fluid, and sometimes attain a large size, and are then readily distinguishable by their history and physical characters.

Cystic tumours, the product of friction or pressure, are found over the patella, on the dorsal aspect of the clubbed foot, and in other localities which are subjected to irritation by certain occupations; also in connection with single tendons or muscles, or with bundles of tendons, as in the hand. They usually contain serum or synovial fluid; but sometimes opaque matter of thicker consistence.

Fatty tumours are generally of slow growth, and entirely unattended by pain. They are chiefly found on the surface of the body, and present either a circumscribed prominence, or, though more rarely, exist as an undefined redundance of fat at some particular part. They affect the trunk more than the extremities, and are found most frequently on the back of the neck, the shoulders, and loins; rarely below the knees or elbows: occasionally two or more coexist. They are readily, though not loosely, movable; for, though the defined form of fatty tumour is surrounded by a thin capsule, it is not otherwise detached from the surrounding subcutaneous fat. These tumours have no regularity in form, but extend in circumference as well as thickness, if not interfered with; sometimes they become pedunculated. To the touch they present the consistence and feel of fat, being more or less irregular, elastic, and yielding;

occasionally they attain a very large size. Their vascularity is trifling, and they are not the cause of pain, unless indirectly by pressure on sensitive parts. They show no tendency to inflammation; though troublesome ulceration sometimes occurs in a pedunculated fatty growth. Fatty tumours may be distinguished from fibrous or fibro-cellular tumours by the greater firmness and elasticity of the latter, which are also usually found where the former are rare, especially about the organs of generation.

Cartilaginous tumours, or *Enchondroma*, are more frequent in early than late life. They vary much as to rapidity of growth; and are met with chiefly, though by no means exclusively, in connection with long bones, near to joints, and on the fingers. They are usually painless themselves, though sometimes the source of pain from tension and pressure on surrounding parts. They are firmly attached, generally by a broad base, and immovable. They are, in some instances, uniform and smooth, in others nodulated on the surface; generally firm, with a certain amount of elasticity; but occasionally yielding readily under pressure, though as readily regaining their former shape. They attain, in some cases, a very large size; and interfere seriously with the functions of parts and organs near or to which they are attached. Occasionally they become ossified; and in some instances manifest a tendency to softening and degeneration.

Osseous tumours are connected with the same parts, usually, as the cartilaginous growth, and possess many characteristics in common with them. They are distinguishable by their unyielding hardness: they are of slow growth.

Myeloid tumours also occur chiefly in connection with bones, growing either in their structure and expanding them, or, though more rarely, from their surface. They are met with chiefly in early life, and are of slow growth; their consistence varies, being sometimes firm, in other cases softer and more yielding;

their surface is generally uniform. They are usually painless, and show no tendency to ulcerate, nor to return when removed.

The various forms in which *Cancerous* tumours present themselves, their almost universal diffusion, their extension from one tissue to another, their varying characteristics in rapidity of growth, the suffering entailed, their destructive interference with neighbouring organs, and the varying tendency of their later stages, render it difficult to define briefly how to distinguish these from all other tumours. The subject will be best illustrated by example, and by comparing cancer with other tumours in bones, the testicle and the breast.

Long Bones in the neighbourhood of joints, as the tibia and femur, near to the knee, are the subject of *osseous* and *cartilaginous* tumours, as well as of *myeloid* disease, the characters of each of which have been described. These parts are likewise obnoxious to *cancer*, in the medullary, or colloid form. Soft cancer invades the interior, and grows from the exterior, of bones; and generally the surface, texture, and medullary canal are simultaneously attacked. In this way the outer walls and cancellous structure of the articular ends of a bone may become expanded and thinned, containing deposits of cancerous matter; or these parts may be the seat of osteoid cancer. In the diagnosis of these malignant growths, the hereditary tendency, past and present health of the patient, the history of the disease, its primary development, its duration, rapidity of growth, and the suffering it has entailed, all have an important bearing. Whether on the surface, or in the interior, of the bone, the disease forms an integral part of it. Its form varies; but the expansion of bone is generally more uniform than the external growth; it varies also in consistence, being, however, generally firm, though unequally so; softened at some parts, at others hard, nodulated, and even crackling under pressure, from the partial resistance offered by the thin wall of bone around it. This disease is usually attended by much suffering to the patient, and the health becomes seriously involved; if the skin yield at any point, fungating growth follows, in some instances accompanied by much bleeding. Its ultimate tendency is certainly fatal. This disease attacks the jaws and pelvis as well as the extremities.

The foregoing tumours are to be distinguished from *scrofulous* disease or tubercular deposit, in the cancellous structure of the extremities of long bones. Such infiltrations run the course of similar disease in the vertebræ or tarsal bones, terminating in caries and suppuration.

The TESTICLE is the seat of many forms of tumour, such as *tubercular*, *cancerous*, *fibro-cystic*, and *cartilaginous;* besides being liable to changes and enlargement, consequent on injury or inflammation of its structure or coverings.

The physical characters of these various swellings are so much modified, or rather assimilated, in many instances, by the dense fibrous investment and interstitial tissue of the organ, that the surgeon is compelled to depend very much on the history of the disease and the condition of health of the patient to throw light on the case. Without such assistance, for instance, it would not be always easy to distinguish between medullary cancer of the testicle and hæmatocele; for, generally, the cancerous deposit is bounded, as is the effused blood, by the coverings of the organ; the dense fibrous coat giving an uniform resisting surface in the former, as the thickened vaginal tunic does in the latter. Medullary cancer of the testicle may have cartilage or even bone combined with it, by which its external characters are modified.

Scrofulous disease of the testicle may attain a considerable size, and soften at various points, before it suppurates. Where there are cysts, they may generally be distinguished (apart from other characteristics) by the absence of inflammation or special tenderness, where there is fluctuation.

In the BREAST, again, many different tumours grow, and require careful discrimination. The *mammary glandular* tumours, and *scirrhus* may be selected for comparison. The former of these occur either on the surface of, or within, the true gland-tissue. They are but loosely connected, and are therefore readily moveable, even when partly imbedded in the gland. They grow with varying rapidity, displacing the true gland, and attaining, sometimes, a large size. In consistence they are firm and elastic, but generally irregular on the surface. *Scirrhus* is very hard and heavy, and not elastic, which is especially remarkable where the growth is slow; and it rarely attains a very large size. The development of these tumours is usually slow; but there is considerable variety in this respect. They are not so moveable as the mammary tumour, but seem to be adherent to the surrounding gland; and further, they contract adhesions to surrounding textures, especially the skin, which is often puckered; and the nipple is drawn in. These conditions, together with the history of the disease, the probably inherited tendency to it, the peculiar, sharp, lancinating pain which accompanies it, and the deteriorated health of the patient, are generally sufficient to characterise and distinguish scirrhus of the breast. This organ is rarely the seat of any other form of cancer; as rarely as the testicle is the seat of scirrhus.

Chronic inflammation, with circumscribed induration of the mammary gland, is sometimes accompanied by shooting pain through the affected part, probably indicative of central suppuration; and under these circumstances it might be mistaken for scirrhus tumour, unless attention is paid to the characteristics which have been referred to.

It should be remarked that, though the mammary glandular tumour is usually attended with but little or no pain, small, circumscribed growths, of the same or a similar texture, are sometimes highly sensitive.

WOUNDS OF THE THROAT.

In a case of attempted suicide, by cutting the throat, the first point which demands attention is the bleeding. The wound should be carefully sponged and cleared of clots, and the condition of the large vessels ascertained; and it may be remarked that injury to these—the carotid artery and jugular vein—is very rare, in consequence of the hollow in which they lie, and the prevalent popular conviction, that the speediest method of terminating life in this way is, by opening the windpipe. If the large trunks are cut, the surgeon has rarely any opportunity of exercising his skill. Search should then be made whether any of the branches of the external carotid have been divided; and, if so, they must be tied; and it must be remembered that the existence of one bleeding mouth of an artery implies the presence of another, which either does or may bleed, unless the division be only partial. Yet, even the thyroid, lingual and facial branches are not frequently implicated in these wounds. Smart hæmorrhage being checked, the oozing may be controlled by exposure for a time, and cold. Meanwhile, facility must be given to the patient to expectorate blood or mucus by the wound, supposing the air-passage to be opened. Then, if the wound is long, either extremity of it may be held together with a suture; but the centre must be left open, or suffocation may ensue. The patient should then be placed recumbent, with the head supported so as to facilitate the adjustment, by position only, of the severed air-tube and central portion of the wound. If necessary, the patient's hands must be confined; and, under any circumstances, he must be carefully watched. The only dressing required is some porous material laid over the wound, and of sufficient thickness to protect the exposed trachea from the ingress of foreign particles, and also to act as a respirator in warming the inspired air; indeed, an ordinary respirator may, in some instances, be conveniently adopted. Then, as regards nourishment; if the patient can, and will, swallow, no artificial assistance is required, care being taken that the food is imbibed slowly, lest choking fits be produced. But, if requisite, liquid food and drink must be introduced through a tube. For this purpose a full-sized elastic gum catheter may be used; being passed through the mouth into the pharynx, well beyond the wound. A bottle or syringe is then employed to inject the food. Whenever the patient has a severe fit of coughing, it is desirable that the wound should be uncovered and cleansed of the expectoration.

These wounds must heal by granulation: to attempt to close them is not only useless but prejudicial. At a later period of the cure, it may be expedient, provided the patient can breathe freely through the glottis, to approximate the granulating edges, lest the skinning process anticipate their coalition, and thus render a permanent fistula possible.

FOREIGN BODIES IN THE PHARYNX AND TRACHEA.

Foreign bodies of various kinds occasionally stick in the pharynx or œsophagus; and prompt treatment is required for their removal. Such bodies may lodge in consequence of their size, as a lump of meat; or from their form, as pins, fish-bones, or such like objects. In the case of a piece of meat or similar soft body plugging the tube, it may be withdrawn with a pair of long, narrow, curved and dentated forceps;

polypus forceps may answer the purpose; and this is the proper method of proceeding where the object is high up: but if low down, in the œsophagus, it may be quite out of reach, and then a probang, or œsophagus bougie or tube, must be passed, so as to press the object onwards to the stomach. In this way fragments of bone, which have become impacted low down, may be dislodged. If the object is small, and entangled in the fauces or pharynx, it must be extracted, if possible. For this purpose, the patient must be placed in a strong light, and the mouth thrown widely open. The finger should then be carried behind the root of the tongue, and the foreign body sought for. If seen, it may be seized with a pair of forceps; if only felt, the finger must serve as a guide to the forceps, unless the body can be removed with the finger-nail. In some instances, an emetic, if it can be taken, or tickling the fauces, will aid in the expulsion of a mass of food, if lodged high up. It is very rarely that œsophagotomy is demanded; only indeed, in cases where the impaction of a foreign body resists every other attempt to remove it.

It should be remembered that the irritation, occasioned by the presence of a foreign body, often survives for some time the removal of the irritant, and misleads the patient into the conviction that it is not removed.

The intrusion of a foreign body into the air-passages is fraught with great, though usually not imminent, danger; patients rarely die of suffocation, though often threatened by it; usually, it is the secondary mischief consequent on the presence of an irritating body in the lung which is fatal. It is, however, important that immediate assistance should be afforded; and for this purpose the first step requisite is to ascertain the fact that a foreign body has entered the air-tube, and, if possible, its position. It rarely happens that a larger body than can enter one of the bronchi passes through the chink of the glottis: a foreign body, therefore, may be expected, if lodged, to be in one of the bronchi, and more often in the right on account of its larger size, and its being a more direct continuation of the trachea. Fits of coughing will, of course, throw it forcibly against the glottis at times; and it may thus be accidentally ejected; or it may be so firmly impacted as to be immoveable. In the latter case, the absence of respiratory murmur, whilst the resonance of the lung thus blocked is undiminished, is sufficient to indicate which bronchus holds the intruder.

Where a foreign body of small size is loose, the surgeon should not be hasty to interfere. It is true that the irritation of the object, when it strikes the rima glottidis, produces alarming symptoms; but, as already remarked, these fits are not often fatal. Under these circumstances it may happen that the body is ejected. But this is not to be waited for, if it do not occur within the first two or three days; after that interval the same steps should be taken as where the body is fixed. The proper course is to open the trachea in the usual way; and then to give the patient a chance of coughing the foreign body through the glottis, which more readily allows its passage when the trachea is opened, in consequence, apparently, of diminished irritability of the rima; or, with a long and slender pair of forceps, introduced through the artificial opening, to sound for and seize the body. The experiment, under these circumstances, of inverting the patient, has been successfully tried.

TRACHEOTOMY.

The operation of tracheotomy is not difficult, but requires care, and attention to certain rules, to secure its efficient completion, and the subsequent well-being of the patient. The following observations may be added to the brief description of this operation elsewhere. (See p. 126.)

If possible, the operator should avoid cutting through muscular fibre; and he must not mistake the middle lobe of the thyroid body for muscle, but, if it be in the way, he must press it upwards. Broad and bent spatulæ or blunt hooks may be used to separate the edges of the wound; and, when the tracheal rings are fairly exposed, the tube may be fixed by inserting a sharp hook into it; but this is not always practicable, nor is it necessary. In some instances, from the spasm of the muscles, and consequent depth of the trachea, combined with profuse venous oozing, the operator is compelled to trust to his finger alone to guide him; in which case he must satisfy himself that he has exposed the tracheal rings before he ventures to puncture them; for if there be cellular tissue still covering them, it will become emphysematous, and obscure the subsequent proceeding. In passing the knife into the trachea, it is desirable, if possible, to select the membranous interval between two rings, and to hold the knife, which should be narrow, horizontally; and then turn it, with its edge upwards, and cut in that direction through two rings of the tube: it is unnecessary to cut a piece out. During the progress of the operation, it is desirable, from time to time, to pass a finger down towards the upper outlet of the chest, to feel for the pulsation of any artery which may be within reach; remembering that there are arterial varieties in this region; and that an aortic aneurism, by pressing on the bifurcation of the trachea, may give rise to the symptoms for which the operation has been undertaken. Although it is desirable as a rule to wait, before completing the operation, until bleeding has subsided, yet it must be remembered that *venous* congestion is the consequence of an insufficient supply of air, and will be relieved by its admission into the lungs. It is scarcely necessary to insist on the importance of not disturbing the trachea lower down or on either side, more than is necessary: yet lamentable injuries to the pleura and lung have occurred in consequence of inattention to this precaution. If a child be the subject of the operation, it is essential to be very careful to prevent any interruption from the resistance of the patient.

Then, as regards the introduction of the tube and the subsequent treatment. A tube of sufficient length and proper curve must be used; and it should be provided with a shield, and tapes to secure it round the neck. It is well also that the tube should be double, that it may thus be readily cleansed. The patient should be constantly watched, that the tube may be cleared from time to time, by the cautious introduction of a feather; and the utmost attention should be paid to its security within the trachea; for dyspnœa will necessarily ensue, if the tube be ejected by violent cough; and an attempt to give relief by introducing a feather may then be productive of most serious consequences, by the displaced tube conducting it to the pleura and lung. If the tube be displaced, it must immediately be reinserted. The period during which it must be worn will of course depend on the circumstances of each particular case.

INJURIES OF THE HEAD.

Injuries of the head present so much variety, that nearly every serious case is a study by itself, and requires to be specially considered in all its bearings, rather than to be treated in accordance with particular formulas or precedent. Nevertheless certain axioms may be enunciated in reference to such cases, which may assist in guiding the practitioner in his treatment, though they may fail, in consequence of the complications referred to, in exactly meeting every case. All comprehensive directions must, therefore, be regarded as subservient to modifications, according to the particular features of each individual case.

The vitality of the scalp renders it justifiable to attempt to save it, when isolated and otherwise injured to an extent which would render reunion of skin almost hopeless at other parts. Such torn or contused scalp should be cleansed from all extraneous matter, and then be carefully replaced, and held in position by some simple adhesive plaister. Sutures are both unnecessary and mischievous. Arteries must be twisted or tied, if necessary. And these proceedings are not to be set aside because the skull happens to be denuded of its periosteum: superficial exfoliation may ensue, and yet the scalp may retain its vitality.

The effects of a blow on the head, without evidence of fracture or other organic lesion, may sometimes endure for a long time: weeks may pass without the patient recovering more than temporary or partial consciousness. It is impossible to say whether such condition may be due to any organic lesion, or merely to commotion of the brain, unless death permit of an examination of the head: but it is certain that patients recover from this condition of protracted concussion, though very slowly, and perhaps, in some instances, never entirely. The symptoms may, at an early period, be suggestive of compression, from the profound unconsciousness of the patient; but afterwards may have the characters of commotion of the brain, the drowsy stupor in which the patient lies being partially dispelled when he is roused, but a relapse occurring immediately afterwards. Under such exceptional circumstances, the head should be shaved as in ordinary severe concussion, and cold applied if the scalp be hot. Light nutriment must be given and the bowels kept open, whilst attention is paid to the bladder, which, however, is likely to relieve itself spontaneously. Stimulus should be withheld or cautiously administered if the pulse is rapid; but the circulation must be sustained if feeble. The prognosis in these cases should always be doubtful, because the nature and extent of the mischief are uncertain. Returning consciousness and natural sleep are the most favorable indications.

The trephine should never be used, unless absolutely necessary; but there are certain conditions and circumstances which admit of no hesitation. 1. When a circumscribed portion of the skull is driven in, and there are persistent symptoms of compression, the trephine must be used, if the elevator and small saw will not effect what is required. 2. When a larger fragment of the skull is driven in, and impacted beneath an overhanging angle of bone, symptoms of compression being present, the trephine may be used to facilitate the subsequent use of the elevator. 3. If a foreign body is lodged beneath, or impacted in, the skull, and pressing on the brain, the trephine may be required to remove it. 4. Symptoms of abscess between the bone and dura mater demand similar treatment. This occurs usually after an interval of some days, or even longer, from the receipt of the injury. Fever succeeding rigor, and followed by coma more or less profound; together with a puffy state of the contused scalp, or a foul discharge from a wound, if there be one, and a denuded condition of the subjacent bone, are pretty sure indications of the formation of matter beneath it. In such a case, the escape of pus from an aperture in the skull should not deter the surgeon from giving it more free vent.

But, it is rarely justifiable to trephine for the purpose of discovering supposed extravasation of blood, whether primary or reactionary;—a condition which the symptoms of coma may indicate; though it may remain in the highest degree doubtful where such extravasation is; and whether relief will be given if it be found: for blood may be effused between the skull and dura mater, or into the sac of the arachnoid, or into the substance of the brain. Moreover, such cases may recover without operation; though this is more rare in reactionary, than in primary, hæmorrhage.

Extensive fracture, with depression of a large fragment of bone and laceration of brain, is not necessarily accompanied by symptoms of compression, and should not be meddled with, unless the depressed bone can be raised without risk of aggravating the mischief. The frontal sinus may be broken in, without injury of the internal table of the skull.

Perforation, with the trephine, should be conducted deliberately, for the dura mater ought not to be lacerated; and a light dressing should be applied over the replaced skin, after the parts have been carefully cleansed. If it be necessary previously to divide the scalp, a T shaped or crucial incision answers the purpose. In using the elevator, it is scarcely necessary to say that the fulcrum should be well selected, lest mischief should be done by further depression of bone. (See also p. 103.)

The indenting of young bones of the skull, which may occur without fracture or compression of the brain, requires no treatment.

In illustration of the above principles, some typical cases may be adduced. A man is knocked down by a blow on the head from a brick: he is stunned for a time, but shortly recovers consciousness. On examination, a scalp wound is found on the forehead; and within it, a fracture is discovered, a fragment of bone being driven in and depressed below the level of the surrounding skull. The patient is conscious and uncomplaining: the pupils act, and the pulse is quiet. Still, there is depressed bone: ought it not to be raised? Certainly not. Suppress bleeding: apply a cold lotion: keep the patient quiet and on a low diet, and act on the bowels. He may recover without a bad symptom: or, after a few days, coma may gradually supervene, after shivering and an excited circulation, attended by headache and perhaps convulsion. Then it will be necessary to open the wound, and probably to use the trephine, to set free matter between the dura mater and skull. To proceed further and puncture the dura mater, is not desirable, unless it appear discoloured, softened, and bulging.

The case, however, may be of a different character. The patient may be the subject of an extensive fracture of the skull, and a large fragment may be loosened, and driven through the dura mater into the substance of the brain, which is probably protruding from the wound. Yet the sufferer may be perfectly conscious, and capable of answering questions. What should be done? If there are any loose spicula of bone, they should be removed; and if, without much force, the depressed fragment can be raised, it is well to do so: and even an overhanging angle may be removed for the purpose of facilitating this step. But no violence should be used: and this is not a case for the use of the trephine. Such cases may recover: but generally coma supervenes from extension of inflammatory softening into the neighbouring part of the hemisphere, or from extravasation of blood. All that can be done further in such cases is, to suppress bleeding with a compress, if necessary: to enjoin perfect rest, and a light diet, keeping the bowels open: water dressing is the best application to the wound.

If a patient has fallen from a height on the vertex, and becomes the subject of profound coma, without evidence of serious injury to the part struck, it may be inferred that there is fracture, the consequence of contre-coup, of the base of the skull; and that extravasated blood is pressing on the brain. This diagnosis would be confirmed by the exudation of blood and serum from one or both ears: but this symptom is not necessary unless the petrous bones are broken across, which they usually are: nor is oozing from the ear necessarily indicative of fracture. Again, a patient with such an injury is not always the subject of insensibility: this symptom may not be present at first, but may supervene, when reaction comes on, from extravasation of blood. Or, there may be restless delirium and convulsion, attending laceration of the brain, with extravasation into its substance. Patients rarely recover from this condition. Under all these circumstances, the surgeon must patiently watch the symptoms, though the opportunity is rarely afforded him of doing anything to relieve them by active interference.

It may be remarked that the front and upper parts of the brain are susceptible of injury with more impunity than the lower and back parts. The loss of a considerable piece of the front of one hemisphere does not seem to entail, *per se*, serious consequences.

WOUNDS OF THE CHEST.

In penetrating wounds of the chest or abdomen, involving the contained viscera, prompt attention is generally demanded, though little can be done for a patient under these circumstances: it is wiser, in most instances, to leave the charge of such injuries to nature, watching and assisting, as symptoms calling for interference, may arise.

A wound of the pleura, and even of the lung, may be unattended by serious consequences, if the patient be kept entirely quiet: or the same injury may be followed by emphysema, or extravasation of blood or air into the pleura, and hæmoptosis. A wound of an intercostal or the internal mammary artery may be followed by fatal hæmorrhage. It is better to close such wounds at once, unless steps are necessary to arrest hæmorrhage. Air will almost certainly find its way into the pleural cavity, and partial collapse of the lung result: even blood may be extravasated into the same space, and afterwards become absorbed. But if the lung be so compressed by fluid or air as to threaten suffocation, free vent must be given to it by dilating the wound, or by paracentesis. Pneumonia or pleurisy require treatment according to circumstances. A light diet, of unstimulating character, should be ordered; and perfect rest and avoidance of all sources of excitement enjoined. Cough must be allayed by some simple demulcent; and the chest must be supported as soon as practicable with a flannel or other bandage.

Some remarkable instances of extensive wounds of the lung, and even of wounds of the heart, are recorded, from which the patients have recovered.

WOUNDS OF THE ABDOMEN.

Wounds of the abdomen, which do not penetrate the peritoneum, may give rise to inflammation and suppuration: they should, therefore, be carefully closed, and the patient kept quiet: interstitial abscess, if such form, should be opened early.

If the peritoneum is penetrated, severe, and even fatal peritonitis may follow, though no viscus be implicated. Such wounds, whatever their size, should be closed at once, and the patient must be kept quiet, and on a light diet. It is desirable, in these wounds, to ascertain whether the serous cavity is open; and this may be done, without complicating the mischief, by carefully introducing a finger or a probe, if other manifest indications are wanting. In closing these wounds, regard must be had to their size, as to whether sutures should be used: if employed, care must be taken not to include the peritoneum. When such wounds are large, the intestine or omentum may protrude; in which case they should be returned; and, if necessary, the opening must be enlarged for that purpose. Of course, in wounds of this description, it is often doubtful whether the bowel itself is penetrated; and it is no business of the surgeon to meddle with the wound for the purpose of ascertaining this. He must patiently wait the efforts of nature to repair the mischief, and treat symptoms as they arise. But, in some cases, this fact is not left in doubt, when the wounded intestine presents itself externally. Such wound may be either large or small: and the question which arises, refers to the expediency of closing it by suture. The best practice is to close the opening in a wounded intestine with fine sutures, cutting them off close, and leaving the injured part as near the external wound as may be; and then to close the external wound: but if the wound is not readily accessible without enlarging the external opening and drawing the intestine out, then it should be left alone, and space should be left for the contents of the bowel to escape by the wound in the parietes. Sutures thus applied become surrounded with fibrinous deposit, and subsequently find their way into the bowel.

If, therefore, a case of penetrating or incised wound in the abdomen present itself, the surgeon will first ascertain whether any portion of intestine is protruding: if so, he will return it, enlarging the external wound if the strangulation interfere with this proceeding. If there is no protrusion, he will satisfy himself, by the cautious introduction of a finger or probe, whether the peritoneum is penetrated: not because this would influence his immediate treatment; for, in either case, he must close the wound: but it may guide him in his diagnosis of the future symptoms, as regards external abscess, or local or general peritonitis, and thus assist him in the treatment. If, however, a portion of protruding intestine, or of intestine near to, and readily accessible from, the external opening, is wounded, he will then apply a suture or sutures as described: but he will not explore to ascertain whether such wound exists; nor ought he to disturb the parts to gain access to a wound, if he knows that there is one. A wounded artery, as the epigastric or one of its branches, may require a ligature.

As regards the after treatment: under all circumstances, absolute rest and an abstemious diet are demanded. If wounded intestine is known to exist or is suspected, abstinence should be more rigid; and opium should be given to quiet the peristaltic movement of the bowels. If requisite, an injection may be given to clear the lower bowel; but aperients must be eschewed, at any rate for some days, till the adhesive process has advanced. If peritonitis ensue, it must be treated by fomentation, and local or general antiphlogistic measures, as the circumstances of the case and condition of the patient dictate. Under any circumstances, the prognosis must be a cautious one; as fatal peritonitis may be the consequence of a simple puncture of the parietal peritoneum.

INTESTINAL OBSTRUCTIONS.

Intestinal obstructions arise from various causes, some of which are external, and therefore readily ascertained and dealt with; as in the different forms of strangulated hernia: others are obscure, both as to their nature and position, and therefore perplexing even to the experienced surgeon. These hidden sources of obstruction may be within the bowel, or external to it: amongst the former are, the accumulation of hardened fæces and other concretions, the growth of a tumour or the existence of a stricture: the latter include pressure, by encroachment, from an external tumour, or constriction by a band or abnormal opening, beneath or in which a portion of the intestine may have become entangled. Further, these obstructions may result from the intestine being twisted, or by its being invaginated, one portion within another.

When summoned to a case of obstruction of the bowels, it is the surgeon's first business to ascertain whether there is any external explanation of the symptoms, by examining all the outlets by which a protrusion may take place. He must not, from any motives of delicacy, or otherwise, omit this essential duty. If he find a hernia in a state of strangulation, he will at once take the necessary steps to reduce it; or failing this, to operate. But he may find no rupture: and he should then examine the rectum with the finger. Here again he may discover the cause of obstruction, in the form of a large, solid accumulation of fæces. If so, he will take steps to break it up, with his finger, or with the handle of a spoon or similar instrument. Some warm water must then be injected; and, after it has been returned, the operation must be repeated, until the obstructing mass is removed; further injection of warm water will soon procure the desired relief. But, again, the rectum may be empty, and the explanation of the constipation has to be sought elsewhere and higher up. The right iliac fossa should be examined: it may be tumid from accumulation of fæces within the cæcum; or the symptoms may indicate inflammation and ulceration of the appendix vermiformis. If there is no indication of the presence of mischief in the iliac fossa, the surgeon should then endeavour to ascertain the seat of obstruction by tracing the distended intestine, as this may assist in the future steps of the treatment.

Under these circumstances of doubt and perplexity, what further indications must the surgeon look for, and what course is he to pursue? The history of the case must now be carefully investigated, unless already ascertained. Inquiry must be made whether the patient has ever been the subject of inflammation of the bowels, of an abdominal tumour, of any similar attack previously, or of habitual constipation of the bowels: whether any indigestible food has been taken: whether there was a sudden attack of acute pain; and if so, in what part of the abdomen.

The ordinary symptoms which characterise these cases are: constipation, with distension of the abdomen, and more or less pain, tenderness and sickness. The countenance has an anxious, distressed expression, and the circulation is generally quickened and feeble; the secretion of urine is generally high-coloured, but variable in quantity; and perspiration is often free. But these symptoms vary materially according to circumstances. Thus, the constipation is usually, but not invariably, complete. The pain may be continuous or intermitting, acute or dull, or there may be none at all. Again, sickness is by no means a constant symptom, at any rate as regards its intensity: occasionally it is almost entirely absent. Fæcal vomiting rarely occurs at an early period of the attack. Distension of the abdomen, and that to a distressing degree, is usually a concomitant of these cases of obstruction, from whatever cause; but in some instances it exists to a very limited extent; and occasionally there is none. When it is excessive, the pressure on the diaphragm embarrasses respiration. As regards the urine, it has been remarked that it is generally more abundant when the obstruction is low down in the bowel.

Being now acquainted with the previous history and existing symptoms of his patient, is the surgeon in possession of sufficient information to direct him in his diagnosis and treatment? Unhappily not; for, the irregularity of any of these symptoms, both as to existence and intensity, in relation to any particular form or cause of obstruction, is such, that they can rarely be depended on as a safe or certain guide: but there are certain points which are deserving of consideration. For instance, if the obstruction occurs in a patient who has been the subject of similar attacks before, it may be inferred that the case is one of obstinate constipation from impacted fæces. Or if the symptoms have lasted a long time, and have become urgent only at an advanced stage, the same diagnosis is suggested. Again, if the patient's health has been failing, and the difficulty of relieving the bowels has gradually increased from a period more or less remotely antecedent to the complete obstruction, the gradual encroachment of a tumour, perhaps malignant, on the calibre of the bowel is indicated. But if the attack has been sudden, and severe pain, urgent symptoms, and early prostration mark the subsequent progress of the case, internal strangulation has probably occurred; for these are the symptoms also of a strangulated hernia, where the small intestine is implicated. The resonance, or otherwise, in different parts of the abdomen, and especially along the course of the colon, may assist in defining the seat of obstruction. The introduction of a long tube into the rectum, and the injection of warm water, may aid in the same direction.

But, it must be admitted that no reliance can be placed, absolutely, on any diagnostic sign as to the exact seat or nature of the obstruction, if beyond the reach of sight or touch; and therefore some general principles of treatment must be adopted, as far as the obscure light of each case, and the not very satisfactory experience afforded by statistics, indicate them. To take up, therefore, the supposed case where we just now left it, what is the surgeon to do if the source of obstruction and its position still remain in obscurity, after the preliminary investigation mentioned has failed of determining it? The alternatives presented are, to use injections, to give purgatives, or opium, to perform an exploratory operation, with the view of finding the seat of obstruction and of disentangling the intestine, or to make an artificial opening into the bowel above the obstructed part.

Injections are safe, and should be fairly tried, a long tube being used, if necessary, and passed as high as practicable. Purgatives ought to have a reasonable trial at an early period, calomel with colocynth, or croton oil having the preference. But it is not only useless, but very mischievous to persevere in their exhibition, especially if they aggravate suffering, and produce an active peristaltic movement, which always seems to stop short at a certain point; or if the symptoms have been urgent from the beginning: then they should speedily be relinquished or they may be inadmissible from the commencement of the attack. Their use is most promising in long-continued constipation, where the symptoms have not been pressing, and are not acute. Opium affords relief to suffering, but its curative influence is not to be relied on: indeed, one cannot understand how it can be operative, unless the condition is dependent on muscular spasm.

An exploratory operation is a serious undertaking; but, also, it is, in many instances, the only chance of saving life; though it must be admitted, it is not always successful in relieving, or even in discovering, the seat of obstruction. Yet, it is a hopeful alternative if resorted to sufficiently early. And here is the difficult problem to solve: when should other means be relinquished in favour of operation? It is impossible to give any rule of practice on this point, which is generally applicable; but it may be safely said that an operation is specially indicated where the symptoms resemble those of strangulated hernia of an acute kind; and that, to be successful, it must, as in hernia, be performed early: the lapse of more than two or three days in this condition will probably place the patient beyond the reach of assistance. An artificial opening in the bowel is admissible, only where an exploratory operation fails of discovering or relieving the seat of obstruction, or where the symptoms indicate that the obstacle is in or below the arch of the colon, and would be relieved by an artificial anus in either loin.

The median line, below the umbilicus, is the best position to open the abdomen for exploring; and sufficient aperture must be made to enable the operator to do this effectually. If requisite, it would be justifiable to puncture the intestine with a small trochar and canula, to allow some of the gas to escape from the distended bowel, and thus to facilitate the search. Assistants should be at hand to support the intestines with flannels dipped in warm water; and the incision should be subsequently closed with sutures. The operation for artificial anus in the loin has been already described. (See p. 138.)

The period at which these cases terminate fatally varies extremely, according to the nature and position of the obstruction. In some instances of acute strangulation, the time may be reckoned by hours rather than days; in others, weeks may elapse without any action from the bowels, before death ensues. The causes of death may be gangrene of the bowel, peritonitis, or exhaustion.

STRANGULATED HERNIA.

Although there is such an infinite variety in the peculiarities of strangulated hernial protrusions, yet there are certain features, which are so often met with, that they may be regarded as the usual characteristics, from which others are deviations. Thus, in the male, an inguinal rupture which has descended into the scrotum is the most frequently strangulated: whereas, in the female, a small femoral hernia is most usually met with in this condition. So rarely, indeed, does strangulated inguinal hernia occur in the latter sex, that the surgeon, who has been in the habit of operating, anticipates almost certainly the femoral form of rupture, when he is called to a case in a female.

The contents of a rupture can rarely be ascertained with certainty, before operating, by the touch only but the history may help the surgeon. In small:

recent herniæ, with acute symptoms, it is most probably intestine alone which is complicated: but in older ruptures, which have been reducible or partially irreducible, and in which sudden strangulation occurs, it is probable that omentum will be found in the sac, and behind it a small, firmly strictured knuckle of intestine, that has intruded itself into the pouch, which was usually appropriated to the omentum alone. This is so common an occurrence, and it forms the type of so large a class of cases, that the young operator will do well to search carefully, if he find a mass of omentum in the sac, in a comparatively healthy state; for the intestinal protrusion may be so limited as to elude a hasty examination.

Umbilical hernia is rarely met with except in the female; and most frequently in fat women. These ruptures almost always contain omentum, and generally also intestine, in smaller or larger quantity. When strangulated, they present much uniformity in their configuration, though they vary in their size. Being almost always old ruptures, the skin over the ordinary sac is thin, generally very attenuated, however fat the surrounding parietes may be. Around this central protrusion, and diffused beneath the thicker covering of skin and fat, the fresh descent has forced itself, or the omentum before it: so that a flattened elevation is found extending for a varying distance, partly or entirely round the umbilicus. The extreme tenuity of the skin and usual thinness of the sac in the centre, render it necessary to exercise great caution in cutting down on these ruptures. A simple incision on the *lower* part of the tumour is sufficient to obtain access to the umbilical opening. The operator should remember that the coverings of this form of hernia are very simple and thin; that the sac is, in fact, exposed almost immediately the skin and fat are divided. The stricture should be incised below the rupture:—this is safer than cutting upwards. A limited incision is generally sufficient; for strangulation is the consequence of the accumulation of contents in the sac, rather than of the smallness of the aperture. It is better to open the sac, unless the strangulation is very recent.

Respecting this question of opening the sac in strangulated hernia generally, great difference of opinion exists. With some operators it is the rule to attempt the relief without opening the sac; with others it is the exception. If the inexperienced operator elect to act on the former principle, he will do well to bear in mind that he may push back a rupture without relieving the stricture; that he can have no acquaintance with the actual contents of the sac and their condition; and that the inflammatory products within the sac are returned, together with its other contents, into the abdomen, instead of being allowed an external drainage. Inflamed or congested peritoneum, whether of sac or intestine, are not susceptible of ill consequences from exposure or incision, as the healthy membrane is: and the assumed analogy between this operation and the taxis is not accurate; inasmuch as the success of the taxis is a measure of the resistant strangulation, which may be estimated as much below that of a hernia in which it is necessary to enlarge the opening, before the strictured intestine can be returned. As a rule, the advantages would seem to be decidedly in favour of opening the sac; in exceptional cases, especially of small and recently strangulated femoral herniæ, the stricture may be divided external to the sac.

RETENTION OF URINE; ITS VARIOUS CAUSES AND THEIR TREATMENT.

When a surgeon is summoned to a case of Retention of Urine in the male, his first business, before attempting to relieve the patient, is to ascertain the cause of the retention, by an inquiry into the previous history, as well as the actual condition of the sufferer. This is essential, when practicable, as the treatment must be modified by the circumstances of each case. If the patient is unable to give any account of himself, as from insensibility, the surgeon should at once pass a medium-sized catheter.

Retention of urine may result from a variety of causes, which may be classed under two heads; some obstruction in either the bladder or the urethra, or a paralytic condition of the former, whereby it is unable to expel its contents. Retention may also occur higher up, by obstruction in one or both of the ureters: this, however, is usually partial, being limited to one side; and is moreover beyond the reach of surgical interference: occasionally, under these circumstances, the ureters become enormously distended and hypertrophied.

A *paralytic* condition of the bladder is a very common consequence, indirectly, of obstruction to the passage of the urine: for, the bladder becoming excessively distended, its muscular coat then loses the power of expelling its contents. This is a not uncommon sequence of delayed micturition in cases of enlarged prostate. In other instances also, where spasmodic is superadded to permanent stricture, paralysis of the bladder, from excessive distension, may survive for some days the subsidence of the spasm. Paralysis is also a consequence of pressure on the brain, of fracture of the spine, and accompanies paraplegia from other causes.

The following may be the sources of *obstruction*: cancer of the bladder; simple hypertrophy, or abscess, or scirrhus of the prostate; stone in the bladder, though rarely; stone in the urethra; permanent and spasmodic stricture; abscess in the perineum; lacerated urethra; extravasation of blood in the perineum; extravasation of urine: and the symptoms of each when associated with the history, are generally sufficiently well marked to be recognisable. Thus, if the comparatively rare disease, *cancer* of the bladder, is the cause, dependence must be placed on the history of the case, especially its negative bearings; as well as on the absence of any other explanation of the obstruction: add to these sources of information the gradually increasing suffering and difficulty of micturition; the admixture of blood with the urine; the deteriorated health of the patient; and the difficulty, if not impracticability, of drawing off the water, though the catheter can be passed readily into the bladder, or apparently so; together with the great pain occasioned by this attempt;—and it is probable the patient is the subject of malignant growth within the bladder.

The condition of the *prostate*, as a cause of retention of urine may be surmised from the symptoms, but cannot be satisfactorily ascertained without an examination through the rectum. Its increased prominence, expansion, and its firmness, may be readily ascertained in this way: its sensitiveness, also, may be tested by pressure. Simple hypertrophy is slow in its development, and is characterised usually by well-marked symptoms (p. 147): as is likewise inflammation terminating in abscess (p. 146). In scirrhus, the induration is much greater, and the suffering of the patient considerable, and increased towards the close of life: but the mechanical obstacle to the passage of the urine is the same as in simple hypertrophy.

If a *stone* is lodged in the urethra, it may cause retention of urine, until it is displaced and forced out by the pressure from behind, or until this pressure is sufficient to force a passage for the water by its side. That the latter consequence sometimes ensues is proved by the occasional occurrence of cases, in which the concretion is closely impacted in the canal, but partially grooved or furrowed to allow of the passage of the urine. No doubt such concretions accumulate in this position; but they must have been sufficiently large, in the first instance, to resist expulsion. Retention of the water may, however, be the climax of this gradual blocking of the passage; and it may occur at any part, between the prostate and urethral orifice: the latter position is not uncommon, on account of the contraction at the mouth of the urethra. In the treatment of these cases, the stone must be removed, if within reach, either by dilating or incising the lips of the urethra, and seizing the foreign body with a pair of delicate forceps, or by hooking it out with a strong, bent probe. If in the perineum the stone should be at once removed from thence by incision. But if under cover, or in front, of the scrotum, it should be dislodged and pushed backwards, so that it may be cut out of the perineum; or else pressed forwards to the orifice of the urethra.

In permanent and spasmodic *stricture*, causing retention, the history of the patient is generally sufficient to determine the character of the obstruction, which is confirmed by an attempt to pass a catheter (p. 155).

Perineal abscess, and *extravasation of urine*, are characterised by unmistakeable signs, as well as indicated by their history. In the former, the tense, and acutely tender swelling behind the scrotum; in the latter, the rapid filling and speedily fatal inflammation of the lax areolar tissue of the scrotum, from the sudden and destructive irruption of the urine, and its spreading devastation around, leave but little excuse for an erroneous diagnosis (p. 157).

Laceration of the urethra may result from violence offered to its interior; but, when it causes retention of urine, the injury is usually external, and accompanied by extravasation of blood or of urine into the perineum. The urethra is rarely torn completely across; but such an injury may be a consequence of fracture of the pubic portion of the pelvis. The diagnosis of these cases is usually unequivocal; their history and symptoms render it so; and the treatment admits of no doubt, when the circumstances of the case are defined. If there is bleeding from the urethra, the introduction of an instrument is the best method of stopping it: otherwise ice may be applied to the perineum (p. 154).

We will suppose that a surgeon is summoned to a case of retention of urine, without being acquainted with any particulars respecting the case: how should he proceed? He must first learn whether the patient has been the subject of permanent stricture; and if so, in what sized stream his water was passed. He will then inquire particularly into the nature of the present attack; how it was induced, and how long it has lasted. He will ascertain the degree of distension of the bladder by feeling the hypogastric region. Having satisfied himself of the simple nature of the case, he will proceed to relieve the patient. (For the symptoms and treatment, see pp. 155-6.)

But, the patient may be past middle age, and the symptoms may be those of enlarged prostate rather than of stricture. If such prove, on examination per anum, to be the case, a suitable instrument must be selected and introduced (p. 147). This operation, if properly conducted, is in many instances very simple. The erect posture is the best. A large catheter with a long curve, made either of gum or silver will often enter the bladder without difficulty; care being taken, if a metal instrument is used, not to depress the handle too soon: whereas a smaller and shorter instrument must stop short of its destination; and, if force be employed, it is very likely to perforate the gland, and to be followed by copious bleeding. It is best to try first a gum elastic instrument without the wire, as it is the safest: but if that fail, after firm but gentle pressure has been tried, then the stilet may be introduced, or a silver catheter substituted. Smaller instruments may, if necessary, be subsequently tried: but their shape and length must be the same. The introduction of the finger into the rectum will serve at once as a safeguard and to guide the point of the instrument, as it enters the prostatic portion of the urethra. Unless there be some unlooked-for complication, it rarely occurs that steady and gentle perseverance fails of success. But this may be the case, and the urgency of the symptoms may not admit of temporising, even with opium. If admissible, a dose of opium may be given to allay pain; and then, after an interval, the attempt may be renewed. If still unsuccessful, the case becomes serious and perplexing, for the prostatic enlargement forbids an attempt to puncture the bladder through the rectum: opening the perineum would afford no assistance; and puncturing the bladder above the pubes is an undesirable proceeding, if there be any other alternative for giving relief. Yet, the only other course open to the surgeon, in this otherwise hopeless dilemma, is to force a passage through the gland, which can be accomplished by firmly pressing a metal instrument onwards, taking care that its point is rightly directed towards the bladder. When introduced either by the natural or through an artificial opening, the catheter must be kept in until the bladder has recovered its tone; except in those cases, which are numerous, in which there is but little or no difficulty in performing this operation. Then the instrument may be withdrawn after relief has been given, and introduced at intervals, to draw off the water. This is often required for a lengthened period; and it may be desirable to instruct the patient in the use of the instrument, that he may relieve himself.

If the symptoms indicate the presence of a stone impacted in the urethra, the surgeon may satisfy himself on this point, by carrying his finger along that passage, from its orifice to the prostate gland. If he find one, he will proceed to remove it, in accordance with the directions and with the precautions already given. If, perchance, it should be impacted far back in the prostate, it must be removed by an incision similar to that for the lateral operation, stopping short of entering the bladder. It is not easy to feel a stone in this position: but it may be struck by a catheter ; or the instrument may be felt grating against it, as it is pressed onwards into the bladder : but this condition, as a cause of retention, is not of frequent occurrence. Still less frequently is a stone within the bladder a source of absolute retention: and if so, it would probably be displaced by the introduction of an instrument.

But the retention may be due to other causes. The patient may, indeed, have been the subject of stricture, but he will say that he has always been able to pass his water in a stream, until he felt pain in the perineum, a few days previously: and this may have succeeded an awkward attempt to introduce an instrument, to relieve the stricture, or it may have been quite spontaneous. He would, possibly, add that he had a shivering fit, and subsequently had felt very hot and feverish. His suffering from inability to micturate is greatly enhanced by the pain in the perineum, and by his thirst, which he dreads to satisfy, as he will thereby add to the accumulation in the bladder. On examining the perineum, the true state of the case is apparent, and a prompt and deep incision into the inflamed tissues, and the liberation of the pus, which may perhaps be but a few drops, will afford relief (p. 157).

The case may, however, have taken on the more serious aspect of diffuse extravasation of urine into the scrotum, by the sudden bursting of the urethra behind an old stricture, in, probably, a disorganized urethra. Sloughing is inevitable in this condition; but its extent and the chances of the patient's recovery depend on the early period at which free incisions are made. In some instances, not only is the areolar tissue in the hypogastrium implicated, but a large quantity of urine may be found collected in sloughy pouches in the scrotum and perineum. The constitutional disturbance and suffering are proportioned to the intensity of the inflammation and destruction of tissue: and yet, with attention to cleanliness, ventilation, and security for the escape of the urine, together with a liberal diet and suitable stimulus, it is remarkable what a good recovery many of the worst cases make (p. 157).

Lastly, the surgeon may find the cause of obstruction to be purely accidental. It may be laceration of the urethra, existing as a complication of fracture of the pelvis, or from a fall across some angular and hard body, or from a kick in the perineum. It is well, in such case, if the patient has either not made an attempt to micturate, or has failed in the effort. The immediate introduction of a catheter is required: for, the longer it is deferred the more difficult it is likely to become, in consequence of the increasing ecchymosis in the perineum and around the urethra. The instrument—an elastic one is preferable—when introduced, must be retained for at least two or three days before it is changed: and then another should be cautiously substituted, and worn until the condition of parts proves that it can be safely dispensed with, which is generally, in simple cases, after the lapse of a week: its presence, when no longer requisite, is likely to excite irritation in the canal (p. 154).

ON THE DETECTION AND EARLY TREATMENT OF CERTAIN FRACTURES.

The detection of some fractures requires no skill; the injury is self-evident: but much tact, as well as knowledge, is required for the discovery of some obscure fractures, especially where they occur near joints, and may, therefore, be confounded with dislocation. Injuries to the shoulder and hip are especially obnoxious to this obscurity, for there the muscles cluster thickly around the joints. But in other situations also there may be some difficulty in eliciting the signs of fracture, and this is much enhanced by a want of acquaintance with the proper method of conducting the investigation.

There are certain general rules in making an examination for fracture, which are applicable to all cases. Thus, all unnecessary violence must be avoided, as not only distressing to the patient, but mischievous in its consequences. If fracture is suspected, but no positive or satisfactory proof of its existence can be elicited, it is expedient to treat the case as if a fracture was ascertained, and to make a further examination after the lapse of two or three days. When there is much swelling about the seat of a suspected fracture, so as to render a satisfactory examination impracticable, it is desirable to wait until the effusion has been absorbed: in consequence of the obscurity arising from this cause, the examination should be made as soon after the receipt of the injury as possible. These remarks apply with varied force in different instances: *e. g.* careless violence used in attempting to determine the existence of fracture of the spine might be productive of fatal consequence by compression and laceration of the spinal cord. Again, fractures near to joints, as at the shoulder, are much more masked by effusion than in most other situations.

When examining a patient for suspected fracture, the surgeon must not expect to find all the ordinary signs of such injury always present: indeed, it may be said that no one sign is sufficiently constant, to be regarded as essential to the diagnosis. Thus, fractures may occur, without any one, in particular, of the following signs being present; viz., distortion, unnatural mobility, crepitus, loss of power, pain, swelling or spasm; and yet some of these are sure to exist, and in many instances, all. Information to be derived through the sight is first to be sought; and this includes swelling and distortion. Swelling may, of course, be due to a variety of causes, being often greater in simple contusion than in fracture: but distortion, such as characterises fracture of one of the limbs, can only be due to this cause or to dislocation. The spasm of a broken limb may often be witnessed; and the deformity it produces is often sufficient to indicate the existence and nature of a fracture. For the presence of pain and loss of power, the patient's testimony must be trusted: and sometimes the acuteness of the surgeon may be tested, in these respects, by patients who have an object in deceiving him. Abnormal mobility and crepitus must be elicited by movement of the bone or limb which is supposed to be broken: and this part of the investigation must be conducted in various ways, according to the part examined, as will be presently illustrated. But, distortion, pain and spasm are all, likewise, capable of being made manifest by manipulation. Thus, irregularity of a broken bone, which is not visible, may be tangible, as, for example, in the tibia, when it is broken alone: it is scarcely necessary to add that both pain and spasm may be caused by moving a fracture. Though, as remarked, all of these signs may be present, it is not necessary that they should be made manifest: the examination should not be prolonged after sufficient proof has accumulated to satisfy the surgeon of the existence, position and nature of the fracture; for this is all he needs to guide him in his treatment.

Thus, when called to a case of suspected fracture, the surgeon's first care should be to learn the history of the accident; how the patient fell, was struck, or run over: then he will view the seat of injury, and help himself in this ocular examination, by comparing corresponding parts on the two sides. If requisite, he will next proceed in the investigation by handling the parts, so as to ascertain whether there is unnatural mobility or crepitus, and whether he can produce deformity: and he may again find it useful to call to his assistance a comparison between the corresponding sides of the body. If the fracture is near a joint, and there exists any doubt as to whether it is a dislocation, he must recall all the characteristics of each injury, and compare them, severally, with the signs which are manifested in the case he is examining. But, if there is already too much swelling to enable him to prosecute this examination satisfactorily, he will do well to place the patient in an easy and favorable position, and to resume the inquiry when the swelling has subsided, employing measures in the mean time to accomplish this object.

There are so many features possessed in common by fractures and dislocations, that much caution is necessary, in some instances, in determining the nature of the injury. Thus, there is, usually, deformity, loss of power, pain, swelling and spasm, in both accidents; and even the peculiar rubbing sensation which may be elicited by moving a dislocated bone, and which appears to depend on the effusion and altered condition of the synovia, may be mistaken by an inexperienced hand for the crepitus produced by moving the broken ends of a bone against each other. A severe bruise, likewise, may produce many symptoms which might be mistaken for fracture, especially when there is extravasation immediately around a bone. Inquiry should also be made, in all cases of doubt, whether a patient has been the subject of any previous accident, or was deformed congenitally, or in consequence of any peculiarity in his occupation. Thus, the habit of carrying a weight on one shoulder produces an unequal elevation of the two sides; and the position in which a blacksmith stands, in wielding a heavy hammer, may give a twist to the right leg, by causing eversion of the foot and inversion of the knee.

As in the diagnosis, so in the treatment, especially the early treatment, of fractures, there are general rules to guide the practitioner, which are applicable alike to all cases. Thus, repose of the injured bone, as nearly absolute as possible, and a position which favours the coaptation of the broken ends, are demanded in every instance. In some cases these objects are readily fulfilled, as where the shaft of the tibia alone is broken: whereas, in others, spasm of the muscles offers a very serious obstacle to the adjustment of the fracture. As regards the period for permanently "putting up" a fracture, there is no fixed rule; for, loose and movable fractures, as of the thigh, require the support of apparatus at once; but a fractured leg may be generally laid on its outside, and but lightly confined until the swelling from the effusion has somewhat subsided. The period, also, during which it is necessary to persevere in the use of splints, varies according to the size of the bone, the nature of the fracture, the age and health of the patient, &c. The constitutional treatment must be, in like manner, guided by circumstances. In all cases the surgeon should inspect the fracture from time to time, and re-adjust the apparatus. A few suggestions on the detection and early treatment of some particular fractures will conclude these remarks.

Spine.—In suspected fracture of the spine, the utmost caution should be exercised in moving the patient, and great gentleness in examining the injured part. Any rough movement of the body, or coarse manipulation at the seat of fracture is likely to aggravate the mischief seriously. All that is justifiable is to pass the finger along the ridge of spinous processes to detect any deviation in regularity: and to be satisfied as soon as such irregularity is discovered. At the same time, it must be remembered that, although no fracture can be detected, one may exist, without displacement of the vertebral arch; or the symptoms may be due to extravasation of blood, or only to concussion (pp. 66 and 104).

Ribs.—In examining a patient with fracture of the ribs, it should be remembered that the only displacement admitted of is inwards or outwards. The proximity of the pleura renders it very liable to laceration by the broken ends of the bones; therefore any rough pressure with the fingers at the seat of injury must be avoided: this is not the way to detect crepitus and unnatural mobility. If the open hand be pressed gently over the suspected spot, whilst the patient inspires deeply or coughs, the desired evidence will be elicited. It is very rarely requisite, or even justifiable, to place pads or compresses on the chest to assist in rectifying any displacement of the fractured ends: if perfect repose do not accomplish this, it is not likely that force will. A broad bandage firmly applied fulfils all the indications in ordinary cases of fracture of the ribs (pp. 67 and 128).

Pelvis.—If fracture of the pelvis be suspected, its outline should first be carefully examined, by passing the finger along the crest of the ilium, over the body of the pubes, and down its ramus and that of the ischium, to the tuberosity of the latter: if necessary, these parts may severally be grasped between the finger and thumb, and their mobility be thus tested. Pressure, with a hand placed on the anterior spine and crest of either ilium, as the patient lies on his back, will be attended with abnormal mobility, if the fracture is extensive or complicated. No further apparatus is needed than a supporting bandage; and this not usually, as displacement is trivial, except in fatal cases (pp. 68 and 154).

The *Scapula* may be examined by grasping in succession the internal and inferior angles, and the spine and acromion process: pressure on the coracoid process, whilst the patient breathes deeply, is the way to ascertain whether it is broken (p. 69).

Arm.—Of the fractures below the shoulder, those in the neighbourhood of the elbow and wrist are alone difficult to detect. The olecranon, if broken off, is always more or less separated from the shaft of the ulna, and therefore this fracture is easily detected. The very rare accident of fracture of the coronoid process of the ulna is difficult to detect, except from the loss of resistance and of muscular antagonism, consequent on the injury. When the arm is extended, the triceps, being unopposed by the brachialis anticus and the process, draws the ulna upwards: the arm should, therefore, be kept constantly flexed. Fracture of either condyloid process may be discovered by grasping and moving it: but these injuries, and fractures involving the joint, are often rendered very obscure by the effusion which rapidly succeeds the accident. The integrity of the head of the radius may be ascertained by its following the rotation of the hand; and this may be felt by grasping it between the finger and thumb. When the base of the radius is broken near the carpus, or the epiphysis separated, the examination must be made by placing a thumb on the suspected seat of fracture, whilst the hand is grasped and inverted: in this way both mobility and crepitus may be elicited, by the lower fragment being drawn down and tilted through the agency of the external lateral ligament: but the deformity assists very much in the diagnosis of this injury.

Leg.—Fractures near the knee are not generally difficult to detect, unless there is much swelling: and the superficial relations of the ankle-joint enable the surgeon, generally, to make an accurate diagnosis of fracture in its proximity. Broken malleoli are sometimes marked by effusion for a time; but afterwards, inversion or eversion of the foot, whilst the fingers are pressed on these points of bone, is usually accompanied by palpable crepitus or unnatural mobility, or by both; if necessary, these processes may be grasped between the fingers and thumb, and moved from side to side. Fracture of the fibula, where under cover of the peronei muscles, is often difficult to ascertain positively: but it may be inferred from the concurrent testimony of pain and loss of power, with the history of the accident. It is a far more serious matter to overlook a fracture of the lower, than of the upper part of the fibula; for permanent displacement of the foot may result from neglect of the former, but no lasting ill consequence need ensue from failing to discover the latter. Care must be exercised in handling a loose fracture of the leg, on account of the facility with which a simple fracture may be made compound. It is a safe precaution, in moving a patient who has broken his leg, from the scene of the accident, or from one room to another, before any apparatus is applied, to fix both limbs firmly together: the sound limb thus acts as a splint to the injured member.

The *Hip-joint* is deeply buried in muscles; and therefore fractures in its close neighbourhood cannot be felt, except indirectly; and the diagnosis must be formed from the general signs, rather than from direct evidence. When the fracture is through or below the great trochanter, the immobility of this prominence when the limb is rotated, and crepitus, usually indicate the nature and seat of the injury: but fracture of the neck must be inferred chiefly from the deformity which characterises it (p. 71).

When summoned to a case of injury of the hip, the surgeon's first inquiry should be regarding the mode in which the accident occurred: from the information thus obtained, he may generally form a probable conjecture as to whether he has to deal with a fracture or a dislocation. For, as with the shoulder, fractures about the hip-joint are almost always produced by direct violence; whereas, in dislocation, the force is almost always indirectly applied (p. 88).

But this is only a preliminary step in the investigation. It is better, in the first instance, to examine the patient in the recumbent posture; afterwards, if there be any obscurity, he may be got up; as, thereby, the characteristics of these injuries become in many instances more strikingly marked. Whilst the patient is lying perfectly straight on a bed or couch, with the legs side by side, a careful comparison should first be made between the anterior spines of the ilia, to see that they are on the same level. Then a similar comparison is to be made between the limbs as to their length and position; and a tape or string should be carried from the anterior superior spine of the ilium to the inner malleolus on either side: any difference in length will thus be readily detected; and it will be noticed whether the foot is inverted or everted. If the injured limb is shortened and everted, there is only one other accident, besides fracture of or near the cervix, of which this deformity is suggestive, viz., dislocation on to the pubes, in which these signs also occur. But the other differences are too marked to escape observation. In fracture of the cervix, the accident usually occurs in the elderly, and by a fall on the trochanter: the limb is movable in various directions, and capable of elongation to its normal length, though retraction takes place again, as soon as the extension is relaxed. The thigh can also be rotated; and in performing this manœuvre, crepitus is generally elicited: and notice must be taken, at the same time, whether the trochanter rotates with the shaft of the bone. But, in dislocation on the pubes, the limb, though shortened and everted, cannot be rotated inwards, nor can it be elongated: it is, in fact, fixed in its position; and the head of the bone may be felt on the body of the pubes, beneath Poupart's ligament. In both the backward dislocations of the femur, the limb, though shortened, is inverted: and though it occasionally happens that, in an impacted fracture of the cervix, there is inversion of the limb, and even a certain amount of support afforded to the superincumbent weight, yet the comparative mobility and trivial deformity of the fracture distinguish it from dislocation. But such impacted fractures, with inversion, are very rare.

The question whether the fracture is within or external to the capsule is not of practical importance: the treatment should be the same in both. Fracture of the neck of the thigh-bone should be put up at once, by adapting a long outside splint, which must extend some distance above the trochanter, so as to admit of counter-extension. This splint must be fixed firmly to the entire limb, care being taken that the ankle and foot are protected from pressure by the introduction of soft pads. The perineal bandage, by which counter-extension is to be made, must also be softly padded: its two extremities are to be carried over the notched extremity of the splint, and firmly tied, whilst extension of the entire limb is made by an assistant. But it is not requisite, nor desirable, to to carry this extension to an extreme during the first two or three days.

Fracture through the base of the trochanter may generally be distinguished by the immobility of this apophysis, when the thigh is rotated; the treatment is to be conducted on the same principles as that of fractured neck of the thigh-bone. (See also p. 71.)

It may be remarked that, in relation to fractures of the thigh generally in either sex, fracture of the neck is more frequent in the female than in the male; which is probably due to the greater prominence of the trochanter in the former: and though a fall on that apophysis is by far the most rife cause of such fracture, it may also result from a fall on the knee or foot, when the cervix is weak from attenuation. The shortening of the limb varies considerably in accordance with the elevation of the trochanter. The very rare accident, in which the head of the femur is forced through the acetabulum into the pelvis, may occur: and it is possible for dislocation and fracture to co-exist.

The *Shoulder-joint* and its neighbourhood are subject to many injuries, which have certain features more or less in common; and thus a correct diagnosis is not infrequently perplexing to those who are unfamiliar with these injuries, and who are unacquainted with characteristics by which they may be distinguished from each other. Thus, flattening or hollowing of the shoulder, in a varying degree, will be found in fracture of the acromion process or glenoid cavity of the scapula, dislocation of the head of the humerus, fracture of the neck of the humerus: and in any injury or disease which paralyses the deltoid, and especially the small rotator muscles of the shoulder-joint, whereby stretching of its capsule is permitted; for this effect occurs as a necessary consequence of the loss of the support afforded by their tonic action. Therefore, it must not be concluded, because there is loss of rotundity of the shoulder, that there is necessarily either fracture or dislocation. In such cases as those last referred to, the deformity may be very marked in long-standing disease accompanied by disuse of the arm: but, in cases of recent injury, it would be comparatively trifling, and simply attended by loss of power in the affected muscles, without the characteristics of the other injuries.

When the surgeon is required to examine a case of injury of the shoulder, he should first inquire how the accident happened; whether by a fall on the hand or elbow, with the arm extended, or on the shoulder, with the arm by the side. It is also well, if there be any doubt, to verify the patient's statement by examining the palm of the hand, or the coat worn at the time. As in accidents to the hip, a shrewd surmise may be formed as to the nature of the injury from this information: for, if the momentum of the fall has been received on the outstretched hand or elbow, the consequence is probably either a fracture of the clavicle, or a dislocation of the humerus: but if the fall was directly on the shoulder, it is more likely to be either a fracture of the glenoid cavity or acromion process of the scapula, or of the neck of the humerus. The patient should then be stripped to the waist, and bidden to stand upright, with the arms depending by the side. In this way any difference between the two sides is readily observed. If, in addition to hollowing or flattening of the shoulder, with prominence of the acromion, the injured arm hangs loosely and helplessly, without any effort on the part of the patient to support it, the case is more probably one of fracture than of dislocation; for the latter accident is characterised by fixedness of the arm and its separation from the side, the elbow being usually supported by the sufferer, to mitigate the effect of pressure on the axillary nerves.

But it is only by a careful manual examination of the joint and its neighbourhood, that a satisfactory diagnosis of many of the injuries of the shoulder can be arrived at. The following is the proper way of conducting this examination:—The patient is placed in the upright posture, with his arms hanging by his sides, or supported symmetrically in front of the chest. The surgeon, standing behind his patient, places the forefinger of either hand on the corresponding sterno-clavicular articulation, and carries them simultaneously outwards, along the clavicle, and then around the acromion and along the spine of the scapula: the slightest difference between the normal and injured side will thus be readily detected. It may chance that, in sweeping the fingers over this irregular arch, he may meet with dislocation or fracture of the sternal end of the clavicle, fracture of the shaft of that bone, or of its scapular extremity (p. 68), or there may be dislocation of the clavicle from the acromion (p. 83), or fracture of the acromion itself, or of the spine of the scapula (p. 69). Most of these injuries are readily recognisable from the superficial position of the bones: fracture near to, or dislocation of, the acromio-clavicular articulation may be confounded; but if so, the practical importance is not very serious, as the treatment of these accidents is essentially the same; though that of the dislocation is generally more tedious than of either of the fractures, in consequence of the laceration of ligament by which it is attended.

But neither of the above injuries may be discovered, and thus the question becomes much circumscribed; for, if there is any accident to joint or bone, it must be either a fracture of the glenoid cavity or neck of the humerus, or a dislocation of the head of the latter. As regards splitting of the glenoid cavity, it may be remarked that it is a very rare accident, that the attendant swelling is great, and that the signs of its presence are the same as those of fracture of the neck of the humerus, except that the head of the bone, in the latter accident, is immovable when the shaft is rotated. For practical purposes, however, the rarity of fractured glenoid cavity limits the doubt usually to the alternative of fractured neck of the humerus and dislocation. The presence of the head of the humerus beneath the pectoral muscle, or in the infra-spinous fossa (p. 84), together with the position of the arm, generally suffices at once to distinguish these accidents: therefore, the diagnosis lies really between dislocation into the axilla and fracture of the neck, where any doubt exists.

It cannot be denied that, although the distinguishing signs of these injuries are generally well marked, there are occasions when some doubt may reasonably exist; and, perhaps, others in which, from want of experience and proper information, there is perplexity where there ought to be none. When the swelling from effusion is very great, and the accident occurs in an aged and fat person, in whom the muscles are feeble and lax, and where no satisfactory account can be obtained of the mode in which the accident happened, some hesitation is excusable. Under such circumstances, it is better to wait until the swelling has subsided, than hastily and recklessly to apply force in attempting to treat a case, which may be fracture, as if it were a dislocation: though it should be remembered that the earliest period is the best to reduce a dislocated bone. The diagnostic signs of each of these injuries have been already described (p. 85): it may here be repeated that the indications most to be depended upon, apart from the way in which the accident occurred, are, the passive mobility of the humerus in fracture, the shortening, or absence of elongation of the limb, the presence of bony crepitus, and, beyond all, the practicability of restoring the rotundity of the shoulder. For the purpose of testing the presence of these and other signs, the surgeon should bend the elbow to a right angle and press it upwards, whilst he fixes the scapula: no striking change of configuration of the shoulder, no obliteration of the hollowing of the deltoid, are thereby produced in dislocation. Retaining the arm in the same position, he will then rotate the humerus, by acting on it through the forearm, whilst with the other hand he grasps the shoulder, and endeavours to feel whether the head of the bone moves in concert with the shaft: likewise, by transferring his hand to the axilla, he will seek to ascertain the same fact, and judge also whether it is really the head or fractured extremity of the shaft which he feels there, when the arm is separated from the side. Lastly, he should carefully measure each arm from the point of the acromion process to the outer condyloid process of the humerus; as perceptible lengthening belongs to axillary dislocation, and not to fracture. The possible complication of the two injuries existing simultaneously need not trouble him, for it is of very rare occurrence.

Finally, if the signs of both dislocation and fracture are absent, with the exception of disability of the patient to raise his arm, of some falling of the humerus and consequent prominence of the acromion, and limited flattening of the shoulder, which can be obliterated by raising the humerus perpendicularly, the scapula being fixed, he may conclude that the case is one of contused and disabled muscles, involving probable injury to the supplying nerves, and requiring the same treatment as fractured neck of the humerus.

Injury to the humerus, in the neighbourhood of the shoulder-joint, may be a separation of the epiphysis in the young, or a fracture above or through or below the tubercles in the adult. The treatment consists in placing a soft but firm pad in the axilla, which must be fixed there by a bandage or handkerchief carried over the opposite shoulder; the application of a short splint on the inside of the arm, and of a long outside shoulder-splint of leather or wood, which should envelope the shoulder and extend to the elbow. The arm must then be confined to the side by a belt or bandage, and the elbow supported. Previous careful bandaging of the entire arm prevents or limits the œdema consequent on interruption of the circulation from pressure in the axilla.

ON SUSPENDED ANIMATION, AND ITS TREATMENT.

Suspended Animation may result from a variety of causes, some of which may occur in the Surgeon's practice, or require surgical interference for their removal or relief: and it may happen in the preparation of his patient for operation, and then demand his presence of mind and utmost promptitude of action to avert a fatal issue.

Suspended animation may be only apparent, as in syncope from loss of blood, or in the exhaustion following convulsive attacks, such as epilepsy or hysteria: this condition is only such a depression of the acts of respiration and circulation as for a time deprives the brain of its normal stimulus. Where animation is really suspended, the act of respiration has ceased, though the heart may continue to act for some time afterwards. The term asphyxia has been usually employed to designate this condition, whatever may be the cause of it; and this has led to an indefinite application of the word, which, indeed, its etymology permits. Thus, we speak of a patient being partially asphyxiated, or under circumstances tending to asphyxia; meaning that the state of the patient, if not relieved, will probably terminate in his becoming pulseless, because deprived of the influence of oxygen on the blood. The complete deprivation of respirable air, or incapacity to breathe, is more accurately expressed by the definite word, apnœa. But, as this expression is absolutely privative, as regards respiration, it is convenient also to retain the word asphyxia, as conventionally more generic in its application.

Asphyxia may be induced either rapidly or slowly, and results either from (1) some mechanical obstacle to the admission of air into the lungs; or (2) from the pollution of atmospheric air, or the substitution of other gas; or (3) from a paralysed condition of the respiratory muscles, consequent on obtuse or suspended nervous sensibility. Under the first head are included such causes as hanging; drowning; closure of the mouth and nostrils; violent compression of the chest and abdomen; collapse of the lung, from the accumulation of fluid or air in the pleura; laryngitis, spasm, or œdema of the glottis; foreign bodies in the larynx, trachea, or pharynx; the pressure of an aneurism or other tumour on the air-tube: immersion in carbonic acid gas may be also added to this list, for its effect is to produce complete closure of the glottis. The second category includes all other gases or mixtures of gas, except the atmospheric air; for all are either negatively poisonous by being incapable of supporting life, as nitrogen, or positively so by acting as irritants or narcotics. In the third class are included those cases which are dependent on the influence of narcotic poisons, and injuries directly or indirectly involving the respiratory nervous centre. Atmospheric air may also be polluted, by being made the vehicle of anæsthetic and other vapours.

From the above enumeration, it is obvious that many of these cases necessarily come under the notice of the surgeon, and require his manual assistance: thus, obstructions of every kind in the air-tube may demand an operation for their removal; injuries of the chest come under his care; and suspended animation, resulting from the poison of chloroform, may tax his knowledge and skill. The proper mode of dealing with obstructions in the air-tube or pharynx has been already adverted to; as well as the way of remedying compression of the lungs by air or fluid: and it may be here remarked, that œdema of or around the glottis, resulting from a scald, may require the operation of tracheotomy to save life. Where none of the above remedies are available, the condition of apnœa must be treated by artificial respiration, and an attempt to excite a natural respiratory act. Before proceeding briefly to consider how these conditions are to be fulfilled, a few words on the subject of death from chloroform may not be irrelevant.

Whether choloform produces any actual change in the condition of the blood, or in the physical condition of the blood-corpuscles, and their relation to each other and their containing vessels, may be an interesting speculation or subject of investigation; but it can scarcely have any bearing on the important inquiry, how to guard against its deleterious influence, and how to recover a patient when in a state of apnœa from an overdose of it. Many of the phenomena attending its inhalation hold a close analogy to those of intoxication; often patients pass through the various stages of exhilaration, depression, and stupor, before becoming entirely insensible. Blunted susceptibility to pain is a characteristic of intoxication: and we often notice that patients, under the influence of chloroform, shrink from the knife, though they have no after-recollection of the suffering; just as the mutilated drunkard awakes up to a consciousness of present pain, but is forgetful of all the circumstances attending his accident. The appeal is made to the brain through the same nerve, the pneumogastric, and the susceptibility of different individuals to the influence of the vapour varies as much as in the case of alcohol. Further, the attendant symptoms of their fatal imbibition are, in some instances at least, not unlike, allowance being made for the rapid and, at the same time, evanescent quality of the one poison, and the slower, but more substantial and enduring, influence of the other. It is on this evanescent property of chloroform that we ground our hopes of resuscitating a patient in whom animation is suspended from its inhalation: and in measuring its effects and comparing their quality with those of intoxication from alcohol, it must be remembered that the vapour not only pollutes the air, but actually precludes a certain portion from exerting its decarbonizing power on the blood. This circumstance, together with the direct influence of the poison on the respiratory centre, and the lowered susceptibility of the sentient extremities of the pneumogastric nerves, seem to offer a satisfactory explanation of the combined state of apnœa and narcotism, which marks the fatal influence of chloroform;—an explanation which is not inconsistent with the fact that frequently its earlier effect is, as with alcohol, to stimulate the brain.

Be this, however, as it may, the practical questions are, how to keep the action of the anæsthetic within due limit; and how, in case of necessity, to restore suspended animation. The condition of the pulse and respiration are, no doubt, important indications to be attended to: and the rapidity, strength, and other qualities of the former should be tested *before* inhalation is commenced, in order to institute a comparison during its exhibition. The healthy state of the heart and lungs should also be ascertained.

The most important precaution to attend to during inhalation, is to secure a free admixture of atmospheric air with the vapour: probably a neglect to do so is the most rife cause of fatality, if not the only one. But different individuals are variously affected by the anæsthetic; and it is almost, if not quite, impossible to predicate beforehand what may be the susceptibility of any particular individual. Moreover, the indications of insensibility to pain are, with one exception, so inconstant, that they are not to be relied on: that exceptional sign is, however, a very simple one, and correspondingly safe. It consists, as already noticed (p. 168), in making a compact with the patient to manifest some given sign of consciousness when appealed to: and it is based on the assumption that consciousness, or the exercise of volition, and sensibility to pain are simultaneously suspended.

The treatment of apnœa, from whatever cause except mechanical obstruction, must, with certain modifications, be conducted in the same way. The desideratum is to restore respiration; and the effort must be to accomplish this, if possible, by exciting acts of natural respiration, or by artificial respiration. The former consists in dashing either cold or hot water on the face and chest of a patient; it is perhaps better to alternate the high and low temperature; for if the surface become chilled, cold ceases to stimulate the respiratory effort. The chest should be alternately compressed and allowed to expand, in imitation of natural respiration: and this may be done either by simple compression of the chest; by rolling the patient over on his side, as recommended by Dr. Marshall Hall; or according to the following directions of Dr. Sylvester, which would appear, from a report of the Committee appointed by the Medical and Chirurgical Society, to be the most approved.

The body should be placed supine, on a flat surface or slightly inclined plane, the shoulders being supported. The tongue is to be drawn forwards, so

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